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DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

G. & G. SURVEY

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UNITED STATES COAST PILOT

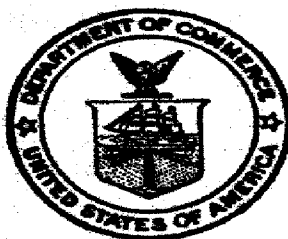
ATLANTIC COAST

SECTION C

SANDY HOOK TO CAPE HENRY

INCLUDING DELAWARE AND
CHESAPEAKE BAYS

[SECOND EDITION.]



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NOTE.

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360° , and are followed by the equivalent *magnetic* value in points in parentheses. General directions, such as northeastward, west-southwestward, etc., are magnetic.

Distances are in *nautical miles*, and may be converted approximately to statute miles by adding 15 per cent to the distances given.

Currents are expressed in knots, which are nautical miles per hour.

Except where otherwise stated, all depths are at *mean lower low water*.

Supplements and other corrections for this volume are issued from time to time and will be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

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INTRODUCTORY.

DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, June 1, 1924.

This publication covers the coast from Sandy Hook to Cape Henry, including the Delaware and Chesapeake Bays and tributaries, and the inside route from New York to Norfolk. It is based mainly upon the work of the United States Coast and Geodetic Survey, including the results of special examination in 1922 and 1923.

This volume covers the same territory as the first edition of Section C, excepting that the inland waterway along the coast of New Jersey has been omitted, as this route is fully described in the Inside Route Pilot, Coast of New Jersey. The present (second) edition has been prepared by Commander Paul C. Whitney, hydrographic and geodetic engineer, United States Coast and Geodetic Survey.

Great courtesy has been shown by the United States engineers, the Lighthouse Service, and local authorities in furnishing information for use in this publication.

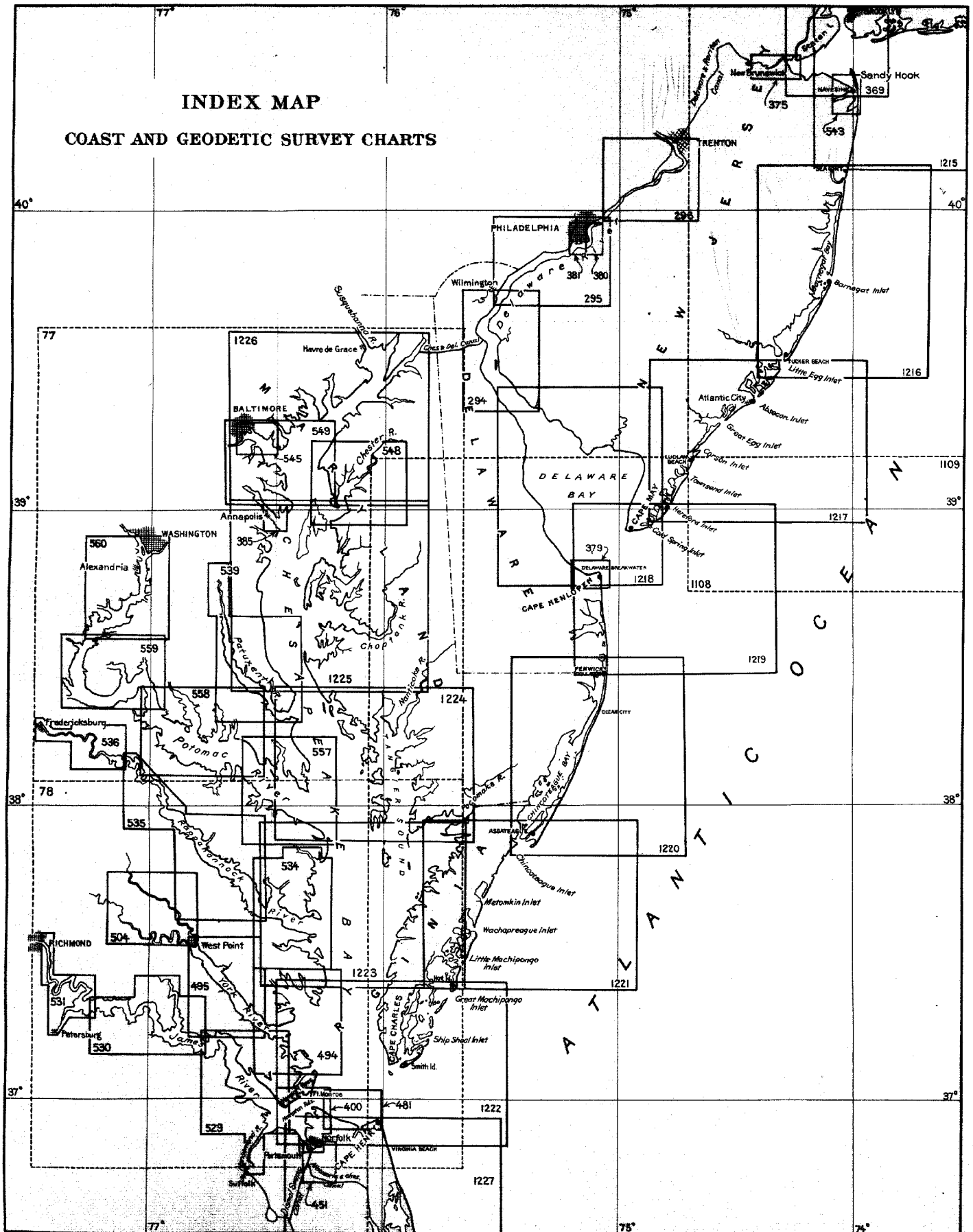
The aids to navigation are corrected to May 30, 1924.

Navigators are requested to notify the Superintendent of the Coast and Geodetic Survey of any errors or omissions they may find in this publication, or of additional matter which they think should be inserted for the information of mariners.

E. LESTER JONES, *Director.*

INDEX MAP

COAST AND GEODETIC SURVEY CHARTS



UNITED STATES COAST PILOT.

ATLANTIC COAST—SECTION C—SANDY HOOK TO CAPE HENRY.

GENERAL INFORMATION.

The information contained in this volume, Section C of the "United States Coast Pilot, Atlantic Coast," relates to the coast from Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays and tributaries, and the inside route from New York to Norfolk, and embraces the coast of New Jersey, Delaware, Maryland, and a part of Virginia.

The general character of the coast is low and sandy, backed by woods, except in the vicinity of Navesink Highlands, where the land reaches a height of 180 feet. The coast of New Jersey is distinguished by the large number of summer resorts, and the coast southward has few natural landmarks except the lighthouses and Coast Guard stations. The depths along the coast are irregular, there being many outlying sand shoals, and the lead is of little assistance to the navigator.

The coast is broken by two important entrances, Delaware and Chesapeake Bays, having broad and deep channels leading into them, and all of the other entrances are narrow inlets, subject to frequent change in depth and position. Inside the entrances there is generally little natural change in the shore, shoals, and other features, except in the more open parts of Delaware and Chesapeake Bays. The only rocky areas within the limits of this volume are a few scattered spots in Delaware River, in Chesapeake Bay above Patapsco River, and near the heads of the larger tributaries on the western side of Chesapeake Bay.

Harbors and ports.—The most important places, either commercially or as harbors of refuge, are Delaware Breakwater, Wilmington, Chester, Philadelphia, Assateague Anchorage, Hampton Roads, Norfolk, Newport News, Richmond, Washington, and Baltimore.

The only anchorages between New York Harbor and Chesapeake Bay entrance available for vessels bound along the coast are Delaware Breakwater, used by vessels of all classes, and Assateague Anchorage, used by small coasting vessels. Small local craft often seek shelter inside the inlets, but they can not be entered in safety during heavy weather, and are often difficult for strangers even in good weather. Hampton Roads is the most important anchorage in the

NOTE.—Instructions regarding "Navigational aids and the use of charts" and other useful data are contained in an appendix beginning at page 242.

southern part of Chesapeake Bay, though vessels entering the bay for shelter often anchor in Lynnhaven Roads in southerly weather. The principal anchorages in Delaware Bay and River are described on page 40, and those in Chesapeake Bay on page 94.

System of buoyage.—In conformity with section 4678 of the Revised Statutes of the United States, the following order is observed in coloring and numbering buoys in United States waters, viz:

In approaching the channel, etc., from seaward, red buoys, with even numbers, will be found on the starboard side.

In approaching the channel, etc., from seaward, black buoys, with odd numbers, will be found on the port side.

Buoys painted with red and black horizontal stripes will be found on obstructions, with channel ways on either side of them, and may be left on either hand in passing in.

Buoys painted with white and black perpendicular stripes will be found in mid-channel, and must be passed close to to avoid danger.

All other distinguishing marks to buoys will be in addition to the foregoing, and may be employed to mark particular spots.

Perches, with balls, cages, etc., will, when placed on buoys, be at turning points, the color and number indicating on what side they shall be passed.

Nun buoys, properly colored and numbered, are usually placed on the starboard side, and can buoys on the port side of channels.

Day beacons (except such as are on the sides of channels, which will be colored like buoys) are constructed and distinguished with special reference to each locality, and particularly in regard to the background upon which they are projected.

Dredging buoys are white with tops for a distance of 2 feet painted green.

Aids to navigation.—The lighthouses and other aids to navigation are the principal guides and mark the approach and channels to the important ports. The buoyage accords with the system adopted in United States waters. The principal coast lights are described in the text of this volume. For a complete description of all lighted aids see the Light List, Atlantic and Gulf Coasts of the United States, published by the Lighthouse Service, which can be obtained from the Superintendent of Documents, Washington, D. C., price 30 cents, or from the agents listed in the weekly Notice to Mariners.

Pilots.—Pilotage is compulsory for certain inward and outward bound vessels in Delaware Bay and River and Chesapeake Bay. Pilots cruise off the entrances of both bays and are always available. Further information concerning pilotage in Delaware Bay and River is given on page 42, and in Chesapeake Bay on page 93.

Local boatmen competent to act as pilots can usually be found near the entrances to the principal inlets and to the tributaries of Delaware and Chesapeake Bays; the charge for piloting in this case is by special agreement with the pilot.

Towboats are stationed at Wilmington, Philadelphia, Norfolk, Newport News, West Point, Washington, and Baltimore.

Harbor masters are appointed for the principal ports, and they have charge of the anchorage and berthing of vessels in their respective

harbors. Harbor and anchorage regulations are given under the descriptions of the ports. The laws prohibit the dumping of ashes or other materials in the channels.

Navigation laws of the United States are published by the Bureau of Navigation, Department of Commerce, at intervals of four years, the the present edition being that of 1923. The volume can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, \$1 for the volume.

Rules of the Road.—International and inland "Rules to prevent collisions of vessels," lines within which the inland rules apply, and "Regulation of motor boats" are published in the Appendix.

Pilot Rules for certain inland waters of the Atlantic and Pacific coasts and of the coast of the Gulf of Mexico are published by the Steamboat Inspection Service in Form 804.

Copies of these pamphlets are furnished by the officers of the Steamboat Inspection Service, and can also be had from the Division of Publications, Department of Commerce, Washington, D. C.

Quarantine.—Quarantine for all ports within the limits of this volume is enforced in accordance with the regulations of the United States Public Health Service, except at the port of Baltimore, where quarantine laws of Maryland and sanitary regulations of the local board of health are in force. The laws of Pennsylvania also govern the ports in that State, and vessels subject to inspection are inspected by both National and State quarantine officials at Marcus Hook. For quarantine for Delaware Bay and River see page 43, and for Chesapeake Bay see page 93. There are national quarantine stations at Delaware Breakwater, Del.; Reedy Island, Pa.; Fort Monroe, Va.; and Alexandria, Va.

Where State quarantine is in force, the minimum requirements are, in general, in accordance with the regulations of the United States Public Health Service. National quarantine regulations will be found at the stations of the service and at American consulates and will be furnished to vessels upon application, either by officers of the service or by the bureau in Washington, D. C. Every vessel should be provided with the quarantine regulations.

Marine hospital.—Information as to relief furnished seamen will be found in the regulations of the United States Public Health Service, which can be consulted at all stations of the service. Such stations are located at ports of any importance, and if not in charge of a service officers, relief will be provided by collectors of customs upon application.

The following stations are in charge of a service officer: Lewes, Del.; Philadelphia, Pa.; Norfolk, Va.; Newport News, Va.; Richmond, Va.; Irvington, Va.; Washington, D. C.; Solomons, Md.; Baltimore (marine hospital), Md.; and Cambridge, Md.

Bridge regulations.—Regulations for lighting bridges over navigable waters, also for lights on sheer booms, piers, dams, and similar obstructions to navigation are prescribed by the Department of Commerce. A copy of these regulations will be sent free of charge to any shipmaster, pilot, or bridge owner on application to the Lighthouse Service, Department of Commerce, Washington, D. C. The superintendents of lighthouses have immediate authority over lighting of

structures in their respective districts and are charged with the enforcement of the regulations. Regulations for the operation of drawbridges are prescribed by the Secretary of War, and extracts from these regulations are given in the description of the waters affected.

Fish weirs are numerous along the outside coast and in Chesapeake Bay and tributaries. The stakes often become broken off and form a danger to navigation, especially at night. Regulations limiting the areas within which fish weirs may be established have been prescribed by the Secretary of War, and the supervision of the fishing structures is controlled by the Chief of Engineers, United States Army. Strangers should proceed with caution when crossing areas of possible fish weirs, and should avoid crossing such areas at night, whenever possible. The areas within which fish weirs are allowed along the coast from Sandy Hook to Cape May are described on page 38, and from Cape Henlopen to Cape Charles on page 80; further information concerning fish weirs in Chesapeake Bay is given on page 96.

Fishing structures and appliances in navigable waters of the United States shall be lighted for the safety of navigation, as follows:

The lights shall be displayed between sunset and sunrise. They shall be placed at each end of the structure excepting where the inner end terminates in such situation that there is no practicable navigation between it and the high-water line of the adjacent coast, in which case no inner light shall be displayed. The outer light shall be white and the inner light shall be red. The size, capacity, and manner of maintenance of the lights shall be such as may be specified in the War Department permit authorizing the erection of the structure or appliance. When several structures or appliances are placed on one line with no navigable passage between them, they will be considered, for lighting purposes, as one structure.

Regulations for passing oredges are prescribed by the Secretary of War for many channels and are given under the descriptions of the channels. Lighthouse tenders, when working on buoys in channels or other frequented water, may display a red flag (international signal-code letter B) and a black ball at the fore, as a warning to other vessels to slow down in passing.

Supplies.—Coal, fuel oil, gasoline, fresh water, and supplies of all kinds are obtainable at Wilmington, Philadelphia, Norfolk, Newport News, Richmond, Washington, and Baltimore. Coal in limited quantities can also be obtained at the other cities and many of the larger towns. Gasoline, provisions, and water are obtainable at practically all of the towns and villages. Further information is given under the different headings.

Repairs.—Philadelphia, Camden, Wilmington, Chester, Norfolk, Newport News, and Baltimore are the principal places at which extensive repairs to the hulls and machinery of vessels can be made. Small vessels and motor boats can be hauled out and minor repairs to machinery can be made at many other places, as mentioned under the descriptions of the towns.

LARGEST DRY DOCKS AND MARINE RAILWAYS.

Port.	Name.	Length over blocks.	Depth on sill at high water.	Capacity.
Sandy Hook to Cape May:		<i>Feet.</i>	<i>Feet.</i>	<i>Tons.</i>
Bay Head.....	Railway.....	1 65	4	
Atlantic City.....	do.....	1 65	5	
Delaware Bay and River:				
Bivalve.....	do.....		7	150
Greenwich Pier.....	do.....	130	8	400
Wilmington.....	Dry dock.....	343	13	
Essington.....	Railway.....	120	6, 14	100
Camden.....	Floating dock.....	230	12	2,000
Do.....	Railway.....	300	11, 16	2,000
Philadelphia (navy yard).....	Dry dock.....	1,011	43	
Port Richmond.....	do.....	412	20	
Cape Henlopen to Cape Charles: Chin-	Railway.....	1 90	7	180
coteague.				
Chesapeake Bay:				
Hampton.....	do.....	1 125	6, 9	125
Norfolk.....	Floating dock.....	180	15	2,000
Do.....	Railway.....	240	6, 15	1,000
Berkley.....	do.....	326	26	1,500
Portsmouth (navy yard).....	Dry dock.....	1,011	40	
Newport News.....	do.....	737	30	
West Point.....	Railway.....	120	12	200
Weems.....	do.....	148	6, 8	200
Alexandria.....	do.....	200	11, 15	
Washington.....	do.....	75		
Washington (navy yard).....	do.....	130	8, 12	500
Solomons.....	do.....	1 125	10	200
Baltimore.....	Dry dock.....	600	22, 5	
Do.....	Railway.....	300	10, 17	1,500
Pocomoke City.....	do.....	125	7	200
Crisfield.....	do.....	100	6	125
Salisbury.....	do.....	125	5, 10	175
Sharptown.....	do.....	173	7, 13	1,000
Seaford.....	do.....	200	12	400
Bethel.....	do.....	100	7	100
Cambridge.....	do.....	1 100	4, 7	150

¹ Length of vessel that can be hauled.

Prevailing winds.—North of the thirty-eighth parallel the prevailing winds are westerly. South of the thirty-eighth parallel they are southerly throughout the year, except in September and October, when they are northeasterly. They are subject to many variations at all seasons. See also the meteorological tables in the appendix.

Fogs are most frequent along the coast during the months of March and April, but may be met with at other times during the year. Easterly winds bring them and westerly and northerly winds clear them away. In the late fall dense fogs are liable to occur, and may last two or three days, sometimes practically suspending navigation in the harbors and bays.

In Chesapeake Bay fogs are most frequent in the spring, fall, and winter months and will sometimes remain for a period of several days, during which time navigation in the bay and its tributaries is seriously interrupted. The most dense fogs and those of longest duration occur from early in November to March. During the summer months there will sometimes be a fog in the tributaries of the bay during the early morning, but it rarely interrupts navigation after the sun is two hours high.

The following table shows the average number of hours per month, from a record of about five years, that the fog signals were operated at the stated light stations of the United States:

HOURS OF OPERATION OF FOG SIGNALS.

Light station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Ambrose Channel light vessel.....	123	86	116	86	113	89	69	43	70	57	55	76	983
Northeast End light vessel.....	124	84	154	121	133	70	35	18	59	64	34	97	993
Overfalls light vessel.....	80	65	71	43	72	58	37	23	55	49	43	43	639
Fourteen-foot Bank.....	92	58	68	30	43	23	13	4	45	27	45	37	485
Ship John Shoal.....	85	48	61	24	27	16	11	5	30	22	52	43	424
Christiana North Jetty.....	59	31	49	12	12	7	6	6	19	12	42	43	298
Cherry Island.....	75	41	56	15	15	5	8	6	20	20	48	45	354
Fort Mifflin.....	48	33	48	16	10	9	11	12	46	24	42	44	343
Fenwick Island Shoal light vessel.....	48	51	57	50	74	49	15	10	23	17	29	29	452
Winter Quarter Shoal light vessel.....	35	50	67	48	68	50	8	6	23	16	25	23	419
Killick Shoal.....	29	38	28	13	26	13	2	1	11	10	26	29	226
Cape Charles light vessel.....	31	36	66	31	33	32	5	3	4	13	50	30	343
Cape Henry.....	46	42	55	41	35	19	0	1	4	18	18	35	314
Thimble Shoal.....	31	31	37	18	15	6	1	1	4	13	23	28	206
Newport News Middle Ground.....	29	23	27	10	8	2	5	1	8	14	23	26	176
Deep Water Shoals.....	32	21	24	6	4	3	1	0	8	9	22	28	158
Jordan Point.....	12	10	8	1	1	0	1	1	2	8	14	15	73
York Spit.....	40	40	47	15	15	6	1	0	4	8	27	35	238
Bells Rock.....	17	18	13	7	3	2	1	0	16	18	23	16	134
Bowlers Rock.....	27	16	8	3	3	3	3	2	8	11	28	14	126
Windmill Point.....	58	46	64	21	18	6	1	0	7	16	25	45	307
James Island.....	51	35	35	10	8	2	0	1	8	3	24	33	210
Smith Point.....	60	58	62	21	19	7	1	0	11	6	23	31	299
Blackstone Island.....	39	28	47	8	5	2	0	0	7	8	31	20	195
Maryland Point.....	39	30	39	6	8	4	1	1	13	14	28	21	204
Fort Washington.....	38	38	27	6	4	4	1	2	20	20	38	21	219
Great Shoals.....	52	37	42	11	7	11	2	3	21	13	26	28	253
Cedar Point.....	60	49	56	17	16	8	0	1	10	12	28	30	287
Sharps Island.....	51	46	45	10	12	3	0	0	4	6	24	22	223
Choctank River.....	59	54	45	10	12	6	4	3	18	13	37	32	293
Bloody Point Bar.....	62	42	46	11	15	4	0	0	8	3	32	22	245
Sandy Point.....	74	53	73	20	20	6	2	1	11	9	35	38	342
Fort Carroll.....	49	29	23	6	2	2	0	1	11	5	33	23	194
Pooles Island.....	30	15	10	5	4	2	0	1	4	3	23	14	111
Turkey Point.....	70	22	54	13	20	9	3	4	10	20	55	45	325

Ice rarely interferes with navigation along the coast, but in severe winters may form a serious obstacle to navigation inside the entrances. Ice conditions in Delaware Bay are described on page 44, and in Chesapeake Bay on page 96. Ice in the tributaries is treated under their descriptions.

Storm warnings are displayed by the United States Weather Bureau on the coasts of the United States and the Great Lakes.

The small craft warning.—A red pennant indicates that moderately strong winds that will interfere with the safe operation of small craft are expected. No night display of small craft warnings is made.

The northeast storm warning.—A red pennant *above* a square red flag with black center displayed by day, or two red lanterns, one above the other, displayed by night, indicate the approach of a storm of marked violence with winds beginning from the *northeast*.

The southeast storm warning.—A red pennant *below* a square red flag with black center displayed by day, or one red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the *southeast*.

The southwest storm warning.—A white pennant *below* a square red flag with black center displayed by day, or a white lantern *below*

a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the *southwest*.

The northwest storm warning.—A white pennant above a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the *northwest*.

Hurricane, or whole gale warning.—Two square flags, red with black centers, one above the other, displayed by day, or two red lanterns, with a white lantern between, displayed by night, indicate the approach of a tropical hurricane, or one of the extremely severe and dangerous storms which occasionally move across the Great Lakes and Atlantic coast.

These warnings are displayed at all stations on the Atlantic and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Turks Island, Bermuda, Haiti, Curacao, Porto Rico, Virgin Islands of the United States, St. Kitts, Dominica, Barbados, Trinidad, St. Lucia, St. Vincent, Grenada, Swan Island, and Cuba.

The following are the storm warning display stations within the limits covered by this volume:

NEW JERSEY:

Atlantic City.¹
Avalon Coast Guard station.
Bivalve.
Cape May Point Coast Guard station.
Great Egg Coast Guard station.
Island Heights (summer only).
Little Egg Coast Guard station.
Long Branch.
Ocean City Coast Guard station.
Sandy Hook.

DELAWARE:

Delaware Breakwater.²
Reedy Island.

PENNSYLVANIA:

Philadelphia, The Bourse.²

MARYLAND:

Annapolis.
Baltimore (American Building).
Baltimore (The Anchorage).
Sleds Point.
Oxford.

VIRGINIA:

Cape Henry.¹
Fort Monroe.
Newport News.
Norfolk (Royster Building).¹
Norfolk (navy wireless).
Reedville.
Weems.

DISTRICT OF COLUMBIA:

Washington (Glesboro).

NOTE.—The Weather Bureau station at Cape Henry, Va., is equipped for day and night communication with passing vessels. The International Code is used by day and the Morse Code, flash-light, by night. Messages to or from vessels will be forwarded to destination.

WEST INDIA HURRICANES.

These are cyclonic storms with a center of lowest barometer, around which the wind blows in a more or less circular course (spirally) in a direction contrary to the hands of a watch. At the same time the storm field advances on a straight or curved track, sometimes with great velocity, and sometimes not more than a few miles an hour, occasionally appearing to come to a pause in its onward movements. The estimated velocity on the Atlantic coast between Hatteras and the island of Cuba is 5 to 15 miles an hour. They cover simultaneously an approximately circular area from 150 to 500 miles in diameter. At the center, the area of lowest barometer, which is from 10 to 20 miles in diameter, comparative calm prevails; the seas within this center are violent and confused, and combined

¹ At these stations barometers will be compared with standards.

² Delaware Breakwater display duplicated on The Bourse, Philadelphia.

with the sudden shifts of wind which are encountered as the vessel passes through the center make this the most dangerous part of the hurricane and the one to be avoided.

Hurricanes form eastward of the Windward Islands or in the Caribbean Sea, and take a westerly or northwesterly course. Some curve gradually northward, passing north of the island of Cuba and northeasterly along and eastward of the Atlantic coast of the United States. Others pass over or southward of Cuba and enter the Gulf of Mexico, and while in the Gulf usually curve northward or north-eastward so as to strike the coast somewhere between Tampa, Fla., and the Rio Grande. Tracks of hurricanes are shown on pilot charts of the North Atlantic Ocean, published monthly by the Hydrographic Office.

The months during which hurricanes are usually encountered are June to November; the months of their greatest frequency are August, September, and October. During these months mariners should be on the watch for indications of a hurricane, and should frequently and carefully observe and record the barometer.

Signs of approach.—First, a long heavy swell, a slight rise followed by a continuous fall of the barometer; second, a strong, gusty wind from some northerly point (northeast, north, or northwest), blowing with increasing force; and third, a rough, increasing sea. If one or more of these signs be wanting, there is little cause for anticipating a hurricane.

The approach of a hurricane is usually indicated by a long, heavy swell, propagated to a great distance two or three days in advance, where there is no intervening land to interrupt it, and which comes from the direction in which the storm is approaching.

One of the earliest signs of a hurricane are high cirrus clouds which converge toward a point on the horizon that indicates the direction of the center of the storm. The snow-white fibrous mare's tails appear when the center of the storm is about 300 or 400 miles distant.

As the storm center approaches, the barometer continues to fall, the velocity of the wind increases and blows in heavy squalls, and the changes in its direction become more rapid. Rain in showers accompanies the squalls, and when closer to the center the rain is continuous and attended by furious gusts of wind; the air is frequently thick with rain and spume drift, making objects invisible at a short distance. A vessel on a line of the hurricane's advance will experience the above disturbances, except that as the center approaches the wind will remain from the same direction, or nearly so, until the vessel is close to or in the center.

Distance from center.—The distance from the center of a hurricane can only be estimated from a consideration of the height of the barometer and the rapidity of its fall and the velocity of the wind and rapidity of its change in direction. If the barometer falls slowly and the wind increases gradually, it may be reasonably supposed that the center is distant; with a rapidly falling barometer and increasing winds the center may be supposed to be approaching dangerously near.

Practical rules.—When there are indications of a hurricane, vessels should remain in port or seek one if possible, carefully observing and

recording the changes in barometer and wind and taking every precaution to avert damage by striking light spars, strengthening moorings, and if a steamer preparing steam to assist the moorings. In the ports of the Southern States hurricanes are generally accompanied by very high tides, and vessels may be endangered by over-riding the wharf where lying if the position is at all exposed.

Vessels in the Straits of Florida may not have the sea room to maneuver so as to avoid the storm track and should use every endeavor to make a harbor or stand out of the straits to obtain sea room. Vessels unable to reach port and having sea room to maneuver should observe the following rules:

When there are indications of a hurricane near, sailing vessels should heave to on the starboard tack and steamers remain stationary and carefully observe and record the changes in wind and barometer so as to find the bearing of the center and ascertain by the shift of wind in which semicircle the vessel is situated. Much will often depend on heaving to in time.

Facing the wind, the storm center will be 8 to 12 points to the right; when the storm is distant it will be from 10 to 12 points, and when the barometer has fallen five or six tenths it will be about 8 points.

A line drawn through the center of a hurricane in the direction in which it is moving is called the axis or line of progression, and looking in the direction in which it is traveling the semicircle on either side of the axis is called, respectively, the right-hand, or dangerous, semicircle, and the left-hand, or navigable, semicircle.

To find in which semicircle the vessel is situated: If the wind shifts to the right, the vessel will be in the right-hand, or dangerous, semicircle, with regard to the direction in which the storm is traveling, in which case the vessel should be kept on the starboard tack and increase her distance from the center.

If the wind shifts to the left, the vessel will be in the left, or safe, semicircle. The helm should be put up and the vessel run with the wind on the starboard quarter, preserving the compass course, if possible, until the barometer rises, when the vessel may be hove to on the port tack. Or if there is not sea room to run, the vessel can be put on the port tack at once.

Should the wind remain steady and the barometer continue to fall, the vessel is in the path of the storm and should run with the wind on the starboard quarter into the safe semicircle. In all cases act so as to increase as soon as possible the distance from the center, bearing in mind that the whole storm field is advancing. In receding from the center of a hurricane the barometer will rise and the wind and sea subside.

The following special signals for surveying vessels of the United States employed in hydrographic surveying have been prescribed:

A surveying vessel of the United States, under way or at anchor in a fairway and employed in hydrographic surveying, may carry where they can best be seen, but in any case well above the rigging lights prescribed by law for preventing collisions, three lights in a vertical line one over the other and not less than 6 feet apart. The highest and lowest of these lights shall be green, and the middle light shall be white, and they shall be of such a character as to be visible all around the horizon at a distance of at least 2 miles. In

the case of a small vessel the distance between the lights of such private code may be reduced to 3 feet if necessary.

By day such surveying vessel may carry in a vertical line, not less than 6 feet apart, where they can best be seen, three shapes of not less than 2 feet in diameter, of which the highest and lowest shall be globular in shape and green in color, and the middle one diamond in shape and white.

Lighthouse tenders when working on buoys in channels or other frequented waters may display a red flag (international signal-code letter B) and a black ball at the fore as a warning to other vessels to slow down in passing.

The wire drags, some of which are over 2 miles long, used by the Coast and Geodetic Survey in sweeping for dangers to navigation, may be crossed by vessels without danger of fouling at any point except between the towing launches and the large buoys near them, where the towline approaches the surface of the water. Steamers passing over the drag are requested not to pass close to the towing launch; also to change course so as to cross the drag approximately at right angles, as a diagonal course may cause the propeller to foul the supporting buoys and attached wires.

RADIO SERVICE.

Time signals.—In connection with the service over the land telegraph lines, time signals by radio are sent daily, Sundays and holidays excepted, from certain United States naval coastwise radio stations. The signals begin at 5 minutes before the hour and continue for 5 minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The final signal is a longer contact after this long break. Hydrographic information, weather reports, and other information of benefit to shipping are sent out from these stations.

The supervision of radio communication in the United States, including the Hawaiian Islands, is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, and Government vessels; Radio Communication Laws and Regulations of the United States; and Amateur Radio Stations of the United States are published by the bureau. Either of the first two publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 15 cents each; the last one, price 25 cents. Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy or 25 cents per year.

The International List of Radio Stations of the World (edition in English) can be procured from the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. In addition to the information contained in the list of the United States stations published by the Bureau of Navigation, the international list shows geographical locations, normal ranges in nautical miles, radio systems, and rates. Supplements to the international list will be issued monthly and will contain new stations and tables of alterations. Inquiries as to the subscription prices of these lists should

be made direct to the Berne bureau at the address given above. Remittances to Berne should be made by international postal money orders.

Radiocompass bearings.—The increasing use of radio directional bearings for locations of ships' positions at sea, especially during foggy weather, has made it particularly desirable to be able to apply these radio bearings sent out by the shore stations directly to the nautical chart. The radio bearings sent out by radiocompass stations are the bearings of the great circles passing through those stations and the ship, and unless in the plane of the equator or of a meridian, would be represented on a Mercator chart as curved lines. Obviously it is impracticable for a navigator to plot such lines on his chart, so it is necessary to apply a correction to a radiocompass bearing to convert it into a Mercator bearing; that is, the bearing of a straight line on a Mercator chart laid off from the sending station and passing through the receiving station.

Below is given a simple formula for the conversion of a radio bearing into a Mercator bearing. This formula is sufficiently accurate for practical purposes for distances up to 1,000 miles.

The only data required are the latitudes and longitudes of the radiocompass stations and of the ship by dead reckoning. The latter is scaled from the chart and the former either scaled from the chart or taken from the list of radiocompass stations printed in the Coast Pilots or on the "Pilot Chart" published by the Hydrographic Office, United States Navy. The largest scale chart available should be used for this purpose.

For ships fitted with radiocompasses taking radio bearings on shore stations or light vessels, see page 16, the same formula applies, only the signs for ship east and west of station are reversed. Also to facilitate plotting, 180° should be added to the Mercator bearing obtained from ship to station and the result plotted from the shore station.

Formula for the conversion of radio bearings into Mercator bearings.—The Mercator bearing is equal to the radio bearing received, plus or minus one-half the convergence of the meridians in minutes, which expressed as a formula is

$$M = R \pm \frac{D}{2} \sin \left(\frac{B + B'}{2} \right) \text{ in which } \textcircled{1}$$

M = Mercator bearing required

R = radio bearing received from the radiocompass station

D = difference in longitude, in minutes, between the radiocompass station and the ship's position by dead reckoning.

B = latitude of the radiocompass station

B' = latitude of the ship's position by dead reckoning.

Use of the signs in the formula.—When the bearings are expressed clockwise from north, in north latitudes, the + sign is used when the ship is east of the radiocompass station; the — sign is used when the ship is west of the radiocompass station. In south latitudes, the — sign is used when the ship is east of the radiocompass station; the + sign is used when the ship is west of the radiocompass station.

The signs are reversed if R in the formula is the radio bearing observed on the ship. M then becomes the Mercator bearing from the ship to the shore station, and 180° should be added thereto when plotting the line on the chart from the shore station.

NOTE.—Where the position by dead reckoning differs greatly from the true position of ship, equation ① should be recomputed, using the new values of latitude and longitude of ship obtained by plotting the corrected radio bearings on the Mercator chart.

Example.—A ship in latitude $37^\circ 20'$ north, longitude $69^\circ 20'$ west by dead reckoning receives a radio bearing of 64° from a radio compass station located in latitude $35^\circ 14'$ north, longitude $75^\circ 32'$ west. Find the Mercator bearing of the ship from the station.

By the formula—

$$\begin{array}{ll} R = 64^\circ & B = 37^\circ 20' \\ D = 75^\circ 32' - 69^\circ 20' = 6^\circ 12' = 372' & B' = 35^\circ 14' \\ \frac{D}{2} = 186' & B + B' = 72^\circ 34' \\ & \frac{B + B'}{2} = 36^\circ 17' \\ & \sin 36^\circ 17' = .59176 \text{ (from the} \\ & \text{table of natural sines p. 13)} \end{array}$$

Substituting these values in the formula, and observing that since the ship is in north latitude and east of the radio compass station, the $+$ sign is used, we have—

$$M = 64^\circ + 186' \times 0.59176 = 64^\circ + 110' = 64^\circ + 1^\circ 50' = 65^\circ 50'$$

Simplified method.—The work of computing is reduced by the use of the table of corrections (p. 13) which gives the values for the term $\frac{D}{2} \sin \frac{(B+B')}{2}$ in the formula. The table is entered with D and $\frac{B+B'}{2}$ as arguments.

In the above example D is $372'$ and $\frac{B+B'}{2}$ is $36^\circ 17'$.

In the vertical column headed by $360'$ and on the same horizontal line as 36° in the left hand column is found the value 106 and next below and opposite 37° is found 108. The difference is 2; therefore the interpolated value for $36^\circ 17'$ is 106.5.

In the same way in the vertical column headed $390'$ the interpolated value for $36^\circ 17'$ is found to be 115.5.

Interpolating for $372'$, between these values of 106.5 for $360'$ and 115.5 for $390'$ gives $110'$, or $1^\circ 50'$ as the value of $\frac{D}{2} \sin \frac{(B+B')}{2}$.

Substituting in the formula this gives—

$$M = 64^\circ + 1^\circ 50' = 65^\circ 50'$$

For practical purposes the foregoing interpolation is unnecessary. Direct use of the nearest value given in the table will result in an uncertainty of only a few minutes of arc.

Table of natural sines.

Mid. L.	Sine.	Mid. L.	Sine.	Mid. L.	Sine.	Mid. L.	Sine.	Mid. L.	Sine.	Mid. L.	Sine.
0°	0.00000	1°	0.19081	22°	0.37461	33°	0.54464	44°	0.69466	55°	0.81915
1°	.01745	12°	.20791	23°	.39073	34°	.55919	45°	.70711	56°	.82904
2°	.03490	13°	.22495	24°	.40674	35°	.57358	46°	.71934	57°	.83867
3°	.05234	14°	.24192	25°	.42262	36°	.58779	47°	.73135	58°	.84805
4°	.06976	15°	.25882	26°	.43837	37°	.60182	48°	.74314	59°	.85717
5°	.08716	16°	.27564	27°	.45399	38°	.61566	49°	.75471	60°	.86603
6°	.10453	17°	.29237	28°	.46947	39°	.62932	50°	.76604	61°	.87462
7°	.12187	18°	.30902	29°	.48481	40°	.64279	51°	.77715	62°	.88295
8°	.13917	19°	.32557	30°	.50000	41°	.65606	52°	.78801	63°	.89101
9°	.15643	20°	.34202	31°	.51504	42°	.66913	53°	.79864	64°	.89879
10°	.17365	21°	.35837	32°	.52992	43°	.68200	54°	.80902	65°	.90631

Table of corrections, in minutes.

Difference of longitude in minutes.

Mid. L.	30'	60'	90'	120'	150'	180'	210'	240'	270'	300'	330'	360'	390'	420'	450'	480'	510'	540'	570'	600'
5°	1	3	4	5	7	8	9	10	12	13	14	16	17	18	20	21	22	24	25	26
6°	2	3	5	6	8	9	11	13	14	16	17	19	20	22	23	25	27	28	30	31
7°	2	4	5	7	9	11	13	15	16	18	20	22	24	26	27	29	31	33	35	37
8°	2	4	6	8	10	13	15	17	19	22	23	25	27	29	31	33	35	38	40	42
9°	2	5	7	9	12	14	16	19	21	23	26	28	30	33	35	37	40	42	45	47
10°	3	5	8	10	13	16	18	21	23	26	29	31	34	36	39	42	44	47	49	52
11°	3	6	9	11	14	17	20	23	26	29	31	34	37	40	43	46	49	51	54	57
12°	3	6	9	12	16	19	22	25	28	31	34	37	41	44	47	50	53	56	59	62
13°	3	7	10	13	17	20	24	27	30	34	37	40	44	47	51	54	57	61	64	67
14°	4	7	11	15	18	22	25	29	33	36	40	44	47	51	54	58	62	65	69	73
15°	4	8	12	16	19	23	27	31	35	39	43	47	50	54	58	62	66	70	74	78
16°	4	8	12	17	21	25	29	33	37	41	45	50	54	58	62	66	70	74	79	83
17°	4	9	13	18	22	26	31	35	39	44	48	53	57	61	66	70	75	79	83	88
18°	5	9	14	19	23	28	32	37	42	46	51	56	60	65	70	74	79	83	88	93
19°	5	10	15	20	24	29	34	39	44	49	54	59	64	68	73	78	83	88	93	98
20°	5	10	15	21	26	31	36	41	46	51	56	62	67	72	77	82	87	92	98	103
21°	6	11	16	21	27	32	38	43	48	54	59	64	70	75	81	86	91	97	102	108
22°	6	11	17	22	28	34	39	45	51	56	62	67	73	79	84	90	96	101	107	112
23°	6	12	18	23	29	35	41	47	53	59	64	70	76	82	88	94	100	105	111	117
24°	6	12	18	24	31	37	43	49	55	61	67	73	79	85	92	98	104	110	116	122
25°	6	13	19	25	32	38	44	51	57	63	70	76	82	89	95	101	108	114	120	127
26°	7	13	20	26	33	39	46	53	59	66	72	79	85	92	99	105	112	118	125	131
27°	7	14	20	27	34	41	48	54	61	68	75	82	89	95	102	109	116	123	129	136
28°	7	14	21	28	35	42	49	56	63	70	77	84	92	99	106	113	120	127	134	141
29°	7	15	22	29	36	44	51	58	65	73	80	87	95	102	109	116	124	131	138	145
30°	7	15	23	30	38	45	53	60	68	75	83	90	98	105	113	120	127	135	143	150
31°	8	15	23	31	39	46	54	62	70	77	85	93	100	108	116	124	131	139	147	155
32°	8	16	24	32	40	48	56	64	72	79	87	95	103	111	119	127	135	143	151	159
33°	8	16	25	33	41	49	57	65	74	82	90	98	106	114	123	131	139	147	155	163
34°	8	17	25	34	42	50	59	67	75	84	92	101	109	117	126	134	143	151	159	168
35°	9	17	26	34	43	52	60	69	77	86	95	103	112	120	129	138	146	155	163	172
36°	9	18	26	35	44	53	62	71	79	88	97	106	115	123	132	141	150	159	168	176
37°	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	163	172	181
38°	9	18	28	37	46	55	65	74	83	92	102	111	120	129	139	148	157	166	175	185
39°	9	19	28	38	47	57	66	75	85	94	104	113	123	132	142	151	160	170	179	189
40°	10	19	29	39	48	58	68	77	87	96	106	116	125	135	145	154	164	174	183	193
41°	10	20	30	39	49	59	69	79	89	98	108	118	128	138	148	157	167	177	187	197
42°	10	20	30	40	50	60	70	80	90	100	110	120	130	140	151	161	171	181	191	201
43°	10	20	31	41	51	61	72	82	92	102	113	123	133	143	153	164	174	184	194	205
44°	10	21	31	42	52	63	73	83	94	104	115	125	135	146	156	167	177	188	198	208
45°	11	21	32	42	53	64	74	85	95	106	117	127	138	149	159	170	180	191	201	212
46°	11	22	32	43	54	65	76	86	97	108	119	129	140	151	162	173	183	194	205	216
47°	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	186	197	208	219
48°	11	22	33	45	56	67	78	89	100	111	123	134	145	156	167	178	189	201	212	223
49°	11	23	34	46	57	68	79	91	102	113	125	136	147	158	170	181	192	204	215	226
50°	11	23	34	46	57	69	80	92	103	115	126	138	149	161	172	184	195	207	218	230
51°	12	23	35	47	58	70	82	93	105	117	128	140	152	163	175	186	198	210	221	233
52°	12	24	35	47	59	71	83	95	106	118	130	142	154	165	177	189	201	213	225	236
53°	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240
54°	12	24	36	49	61	73	85	97	109	121	133	146	158	170	182	194	206	218	231	243

Table of corrections, in minutes—Continued

Mid. L.	30'	60'	90'	120'	150'	180'	210'	240'	270'	300'	330'	360'	390'	420'	450'	480'	510'	540'	570'	600'
55°	12	25	37	49	61	74	86	98	111	123	135	147	160	172	184	197	209	221	233	246
56°	12	25	37	50	62	75	87	100	112	124	137	149	162	174	187	199	211	224	236	249
57°	13	25	38	50	63	75	88	101	113	126	138	151	164	176	189	201	214	226	239	252
58°	13	25	38	51	64	76	89	102	115	127	140	153	165	178	191	204	216	229	242	254
59°	13	26	39	51	64	77	90	103	116	129	141	154	167	180	193	206	219	231	244	257
60°	13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260

The Naval Communication Service will furnish radio bearings to mariners of all vessels equipped with radio-telegraph transmitters. While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radio compass stations are provided, primarily, to assist the mariner in closing the land during fog or poor visibility, but they may also be used to obtain the positions of vessels at sea in radio compass range, about 150 miles, when for any reason positions can not be obtained by other means. The maximum distance for which bearings from these stations are accurate is 150 miles.

Radio compass stations are divided into two classes: (a) Single stations, operating independently and furnishing a single bearing. These stations are located with the view of giving service to ships at a distance of not over 150 miles from the station. (b) Harbor entrance groups. All stations in harbor entrance groups are connected to and controlled by the master station. All stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station. The purpose of these stations is to lead mariners to the light vessels off harbor entrances.

Where only one radio compass station is available, the mariner may fix his position by two or more bearings from the station with the distance run between, or may use the bearings as a line of position, or as a danger bearing. Or the bearing may be crossed with a line of position obtained from an observation of an astronomical body to establish a fix.

Wave lengths.—All independent and group radio compass stations keep watch on 800 meters. Only this wave should be used to call and work with these stations.

Calling a radio compass station.—To obtain a bearing from independent radio compass stations, call the station from which the bearing is desired in the usual manner and request bearings by means of the conventional signal given hereafter. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired. To obtain bearings from the harbor entrance compass stations, carry out the procedure previously given. The compass control station only will answer.

Conventional signals.—The following abbreviated signals will be used:

Signal.	Meaning.
QTE?.....	What is my true bearing?
QTE.....	Your true bearing is degrees from radio compass station.

The following radio compass stations will be of use for vessels navigating within the approximate limits of this volume:

Name of station.	Call letters.	Position.	Arc of calibration.
Fire Island, L. I., N. Y.....	NAH	Lat. 40° 38' 07" N., long. 73° 12' 32" W.....	83-262
Sandy Hook, N. J.....	NAH	Lat. 40° 27' 54" N., long. 73° 59' 50" W.....	0-170
Manasquan, N. J.....	NAH	Lat. 40° 07' 05" N., long. 74° 01' 58" W.....	10-190
Cape May, N. J.....	NSD	Lat. 38° 55' 53" N., long. 74° 54' 35" W.....	40-235
Cape Henlopen, Del.....	NSD	Lat. 38° 47' 35" N., long. 75° 05' 26" W.....	0-200
Bethany Beach, Del.....	NSD	Lat. 38° 32' 45" N., long. 75° 03' 22" W.....	10-200
Hog Island, Va.....	NCZ	Lat. 37° 22' 36" N., long. 75° 42' 37" W.....	50-200
Virginia Beach, Va.....	NCZ	Lat. 36° 51' 10" N., long. 75° 58' 33" W.....	50-200
Poyners Hill, N. C.....	NCZ	Lat. 36° 17' 16" N., long. 75° 47' 48" W.....	354-157
Cape Hatteras, N. C.....	NDW	Lat. 35° 14' 22" N., long. 75° 31' 42" W.....	0-150

PROCEDURE IN DETAIL.

(a) A ship calling the radio compass station or compass control station should make the abbreviation "QTE?" ("What is my true bearing?"). This request will be answered by the radio compass station or control station, and when ready to observe the radio bearing it will send the signal "K," indicating to the ship to commence "testing"; for example, repeating its distinguishing signal for a period of 50 seconds. The signal should be made slowly with the dashes considerably prolonged.

(b) The testing should be made on 800 meters, upon the completion of which the ship should await reply from the radio compass station.

(c) The radio compass station or control station will then reply, repeating the abbreviation "QTE" ("Your true bearing from ----- was ----- degrees"), followed by the bearing in degrees given by a group of three figures 000 to 360, indicating the true bearing in degrees of the ship station from the radio compass station, and then the time group giving the time of observations in local standard time. In the case of more than one radio compass connected by land line only, the station originally called will answer. This station will combine all the bearings taken by itself and associated stations into one message, which gives each bearing observed immediately after the name of the station making the observation. *All compass stations transmit on 800 meters.*

Danger from reciprocal bearings.—Attention is invited to the fact that when a single bearing is furnished there is a possibility of an error of approximately 180°, as the operator at the compass station can not always determine on which side of the station the vessel lies. Certain radio compass stations, particularly those on islands or extended capes, are equipped to furnish two corrected true bearings

for any observation. Such bearings when furnished vessels may differ by approximately 180° , and whichever bearing is suitable should be used.

Caution.—Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearing should never attempt to correct these bearings by applying a correction of 180° , as such correction would not include the correction necessary on account of deviation at the compass station. An error of as large as 30° may be introduced by mariners applying an arbitrary correction of 180° to such bearings. Vessels receiving bearings manifestly requiring an approximate 180° correction should request the other bearing from the radio compass station if not previously furnished.

The arc of calibration is a sector of the circle of which the compass coil at the radio station is the center; the bearings are from the station (clockwise). Compass bearings are reliable only when they fall within the calibrated area.

Bearings, except in the case of approximate reciprocal bearings, should be accurate within 2° of arc provided the transmitting equipment on board vessels is tuned sharply to 800 meters. Operators should use sufficiently wide coupling to obtain low decrement. If radio transmitters are not tuned sharply, it is difficult to obtain bearings that are sufficiently accurate for navigational purposes.

When bearings from three or more compass stations are not over 2° of arc in error, but do not meet at a fixed point, the geometric center of the triangle formed by the bearings can generally be taken as the approximate position of the vessel. Mariners until thoroughly familiar with the system are advised to use radio compass stations frequently, especially in clear weather, when positions of vessels can be accurately fixed in order to accustom operators to the procedure and to acquaint themselves with the degree of accuracy and dependability of bearings furnished by the radio compass stations.

Reports.—In order that the operation of shore radio compass stations may be checked, marines obtaining bearings are requested to forward a brief report to the Director Naval Communications, Navy Department, Washington, D. C., containing the following particulars:

1. Name of ship.
2. Name of radio compass station.
3. Date and local standard time at which radio bearing was taken.
4. Bearings given by radio station.
5. Estimated position of ship at above time and dates by methods other than radio.
6. The probable degree of accuracy of the estimated position.
7. Weather conditions at above time.
8. Remarks, if any.
9. Signature of master or responsible navigating officer.

There is no charge for bearings furnished by the U. S. Naval Radio Compass Station.

Radio fog signals.—The following radio fog signals are operated on the Atlantic coast by the United States Lighthouse Service:

Boston Light Vessel, Mass.:

Group of 1 dash and 1 lot	15 seconds.
Silent	15 seconds.

Nantucket Shoals Light Vessel:	
Group of 4 dashes	30 seconds.
Silent	25 seconds.
Fire Island Light Vessel, N. Y.:	
Group of 2 dashes	50 seconds.
Silent	15 seconds.
Ambrose Channel Light Vessel, N. J.:	
Series of dashes	65 seconds.
Silent	25 seconds.
Seagirt Light Station, N. J.:	
Groups of 3 dashes	30 seconds.
Silent	3 minutes.
Cape Henry Light Station, Va.:	
Groups of 2 dots and 1 dash	20 seconds.
Silent	15 seconds.
Diamond Shoal Light Vessel, N. C.:	
Group of 2 dashes	30 seconds.
Silent	30 seconds.

These radio fog signals are intended for the use of vessels equipped with radio compass. By reason of this radio compass (also termed radio direction finder) the bearing of the radio fog signal station may be determined with an accuracy of approximately 2° and at distances considerably in excess of the range of visibility of the most powerful coast lights. The apparatus is simple and may be operated by the navigator without the assistance of a radio operator or without knowledge of the telegraph code. The radio direction-finding apparatus consists of a radio receiving set, similar in operation to those used for radio telegraph or telephone reception, and a rotatable coil of wire in place of the usual antenna. By rotating the coil the intensity of the signal received from the transmitting station is caused to vary, and by noting the position of the coil when the signal is heard at its minimum intensity the bearing of the transmitting station is readily obtained.

The signals from the light vessels have definite characteristics for identifying the stations, as have the flashing lights and sound fog signals, and bearings may be obtained with even greater facility than sight bearings on visible objects. The radio fog signals are transmitted on a wave length of 1,000 meters, which is exclusively reserved for this purpose to avoid interference. The stations transmit continuously during thick weather and also for one-half hour twice each day, beginning at 9 a. m. and 3 p. m., regardless of weather conditions.

The radio operator on Nantucket Shoals Light Vessel will stand watch on 500 kc. (600 meters) for the first 15 minutes of every hour from 8 a. m. to 10 p. m. for the purpose of answering requests from vessels to transmit radio fog signals. For the first 15 minutes of every hour between 11 p. m. and 7 a. m. the radio fog signal will be operated, and during thick, foggy, or misty weather this signal will be operated continuously.

Vessels are requested to forward reports to Commissioner of Lighthouses, Washington, or Superintendent of Lighthouses, Boston, as to the effectiveness of operation of this signal.

A general description of this method of navigation and the instruments required may be obtained from the Commissioner of Lighthouses, Washington, D. C., upon request. The Bureau of Standards Scientific Paper No. 428, the Radio Direction Finder and

Its Application to Navigation, may be obtained from the Superintendent of Documents, Washington, D. C., for 15 cents.

Radiotelegraphic broadcasts of weather forecasts and information issued by the United States Weather Bureau for the benefit of marine and aviation interests are made daily on regular schedules on the Atlantic coast, Portland, Me., to Cape Henry, Va., from naval radio stations. (Seventy-fifth meridian time is used throughout.)

A major bulletin is broadcast from the naval radio station (NAA) at Arlington, Va., as scheduled below. This bulletin consists of surface weather conditions based upon observations taken at 8 a. m., and p. m., respectively; reports of upper air observations, a synopsis of general atmospheric conditions and pressure distribution, location of high and low areas, wind and weather forecasts for the Atlantic coast offshore areas, and flying weather forecasts for each of the aviation zones in the district.

The wind and weather forecasts contained in the 10.30 a. m., bulletins are for the 24 hours beginning at noon, and those contained in the 10.30 p. m., bulletin are for the 24 hours beginning at midnight.

Arlington, Va. (NAA): 10.30 a. m. (seventy-fifth meridian time), 50 kilocycles (5,950 meters), CW; 10.30 p. m. (seventy-fifth meridian time), 113 kilocycles (2,650 meters), CW.

Local bulletins are broadcast daily, from other naval radio stations in this district, as named below. These bulletins consist of wind and weather forecasts for ocean areas contiguous to the station; storm warnings and advices; and current weather conditions at the stations, including barometric pressure, wind direction and velocity, and state of weather.

Portland, Me. (NAB): 12 noon (seventy-fifth meridian time), 185 kilocycles (1,620 meters), spark.

Boston, Mass. (NAD): 11.00 a. m. (seventy-fifth meridian time), 185 kilocycles (1,620 meters), spark.

New York, N. Y. (NAH): 10.30 a. m. (seventy-fifth meridian time), 195 kilocycles (1,537 meters), CW.

Philadelphia, Pa. (NAI): 10.45 a. m. (seventy-fifth meridian time), 230 kilocycles (1,304 meters), spark.

Norfolk, Va. (NAM): 10.45 a. m. (seventy-fifth meridian time), 162 kilocycles (1,851 meters), spark.

Detailed information regarding these broadcasts and the method of decoding the major bulletin will be found in Weather Bureau circular dated May 16, 1921, and for the local broadcasts in circular dated May 28, 1921. These may be obtained upon application to any coastal station of the Weather Bureau or to the Chief of the Weather Bureau, Washington, D. C.

Free medical advice to seamen by radio.—The Seamen's Church Institute, of New York, announces that through the cooperation of the Seamen's Church Institute with the United States Public Health Service free medical advice for ships at sea is now available through the coastal radio station operated on the Atlantic and Pacific coasts of the United States by the Radio Corporation of America.

The coastal stations and hospitals designated to furnish the service in question are as follows:

Coastal radio stations.	Call letters.	Hospitals designated to furnish information.
Chatham, Mass.----- Siasconset, Mass.----- New York City, N. Y.----- Cape May, N. J.-----	WCC WSC WNY WCY	{ U. S. Marine Hospital No. 70, 67 Hudson Street, New York, N. Y. Alternates: Hospitals 38, 43, 61. U. S. Veterans' Hospital No. 49, Gray's Ferry Road and Twenty-fourth Street, Philadelphia, Pa. Alternate: U. S. Veterans' Hospital No. 56, Fort McHenry, Baltimore, Md.
Algiers, La.----- San Francisco, Calif.-----	NAT KPH	U. S. Marine Hospital No. 14, New Orleans, La. U. S. Marine Hospital No. 19, Fourteenth Avenue and Lake Street, San Francisco, Calif. Alternate: U. S. Veterans' Hospital No. 24, Palo Alto, Calif.

While the Panama Canal was not included in the original scheme, several requests for medical service have been received there from ships at sea and have been given prompt attention.

Ships desiring medical advice can secure prompt service by addressing radiograms to any of the above-mentioned coastal stations with which communication is established, such radiograms to be signed by the master and briefly state symptoms of the person afflicted. The advice given by the above-mentioned hospitals will be phrased in language (English) intelligible to a layman. This free medical service has been established, primarily, for the benefit of ships not carrying physicians. However, should occasion require, consultation may be held by radio by ship's physicians with the hospital staffs.

The United Fruit Co. has established a similar system of free medical advice in the Caribbean and the Gulf of Mexico. A message from a ship's captain to any of the company's radio stations in Central America or Colombia, giving the details of a case of illness or accident on his vessel, will be answered by the company's physicians without charge.

The following information is taken from a circular issued by the United Fruit Co.:

Radiograms requesting medical advice should be signed by the captain of the ship and should state briefly, but clearly, the symptoms of the person afflicted. Such radiograms should be addressed "Unifruitco" (name of place), and may be sent to any of the following United Fruit Co. hospitals: Santa Marta, Colombia; Port Limon, Costa Rica; Almirante, Panama; Tela, Honduras; Puerto Castilla, Honduras; Puerto Barrios, Guatemala.

All United Fruit Co. passenger steamships carry doctors, and free medical advice may be secured by radio from any of them by a radiogram addressed "Ship's Doctor," followed by name of the steamship. This free medical service is established, primarily, for the benefit of ships not carrying doctors; however, should occasion require, ship's doctors may hold consultation by radio with the United Fruit Co. ships' doctors and hospital staffs.

The physicians and surgeons comprising the medical staff of the United Fruit Co. and its subsidiaries are thoroughly qualified, but in view of the fact that radio medical advice to ships at sea is given free and without an opportunity for a personal examination of the patients, no responsibility will be assumed by either the company and its subsidiaries or the physicians or surgeons giving the advice as to its accuracy or for error in the receipt or transmission of any message sent or received in connection therewith.

It is requested that when sending medical advice radiograms, radio operators check them "(Number of words) DH Medico." "DH Medico" radiograms will be given preference over all other radiograms, excepting S O S calls, throughout the radio service of the United Fruit Co. and subsidiary companies.

UNITED STATES COAST GUARD STATIONS.

Coast Guard stations included in this volume are maintained at the places named in the following table. The stations are manned continuously and are supplied with boats, wreck guns, beach apparatus, and all other appliances for affording assistance in case of shipwreck. Instructions to enable mariners to avail themselves fully of the assistance thus afforded will be found in the appendix, page 260.

Name of station.	State.	Locality.
Sandy Hook.....	N. J.	On bay side, $\frac{1}{2}$ mile south of point of Hook.
Spermaceti Cove.....	N. J.	$2\frac{1}{2}$ miles south of Sandy Hook light.
Seabright.....	N. J.	About $1\frac{1}{2}$ miles south of Navesink light.
Monmouth Beach.....	N. J.	About 1 mile south of Seabright.
Long Branch.....	N. J.	Greens Pond.
Deal.....	N. J.	Asbury Park.
Shark River.....	N. J.	North side of the mouth of Shark River Inlet.
Spring Lake.....	N. J.	$2\frac{1}{2}$ miles south of Shark River Inlet.
Squan Beach.....	N. J.	1 mile southeast of Squan village.
Bayhead.....	N. J.	At the head of Barnegat Bay.
Mantoloking.....	N. J.	$2\frac{1}{2}$ miles south of head of Barnegat Bay, on Mantoloking Beach.
Chadwick.....	N. J.	$5\frac{1}{4}$ miles south of head of Barnegat Bay.
Toms River.....	N. J.	On the beach abreast mouth Toms River.
Island Beach.....	N. J.	$1\frac{1}{4}$ miles south of Seaside Park.
Cedar Creek.....	N. J.	$5\frac{1}{4}$ miles north of Barnegat Inlet.
Forked River.....	N. J.	$2\frac{1}{4}$ miles north of Barnegat Inlet.
Barnegat.....	N. J.	South side of Barnegat Inlet, $\frac{1}{2}$ mile south-southeastward of Barnegat light.
Loveladies Island.....	N. J.	$2\frac{1}{2}$ miles south of Barnegat Inlet.
Harveys Cedars.....	N. J.	$5\frac{1}{2}$ miles south of Barnegat Inlet.
Ship Bottom.....	N. J.	Midway of Long Beach.
Long Beach.....	N. J.	$1\frac{1}{2}$ miles north of Beach Haven.
Bonds.....	N. J.	$2\frac{1}{4}$ miles south of Beach Haven and $\frac{1}{2}$ mile north of the new inlet.
Little Egg.....	N. J.	Near Tucker Beach light.
Little Beach.....	N. J.	South side of Little Egg Inlet.
Brigantine.....	N. J.	$5\frac{1}{2}$ miles north of Absecon light.
South Brigantine.....	N. J.	$3\frac{3}{8}$ miles north of Absecon light.
Atlantic City.....	N. J.	At Absecon light.
Absecon.....	N. J.	$2\frac{1}{4}$ miles south of Absecon light.
Great Egg.....	N. J.	$6\frac{1}{4}$ miles south of Absecon light.
Ocean City.....	N. J.	South side of Egg Harbor Inlet, at Ocean City.
Pecks Beach.....	N. J.	$3\frac{1}{4}$ miles north of Corson Inlet.
Corson Inlet.....	N. J.	Near the inlet, north side.
Sea Isle City.....	N. J.	At Sea Isle City, $3\frac{1}{4}$ miles north of Townsend Inlet.
Townsend Inlet.....	N. J.	Near the inlet, north side.
Avalon.....	N. J.	$3\frac{1}{4}$ miles southwest from Ludlam Beach light
Stone Harbor.....	N. J.	$2\frac{1}{2}$ miles northeast of Hereford Inlet light.
Hereford Inlet.....	N. J.	Near Hereford light.
Holly Beach.....	N. J.	6 miles northeast of Cape May City.
Two Mile Beach.....	N. J.	4 miles northeast of Cape May City.
Cold Spring.....	N. J.	$\frac{1}{2}$ mile east of Cape May City.
Cape May.....	N. J.	Near the light.
Lewes.....	Del.	2 miles west from Cape Henlopen light.
Cape Henlopen.....	Del.	$\frac{1}{2}$ mile southerly of Cape Henlopen light.
Rehoboth Beach.....	Del.	Opposite north end of Rehoboth Bay.
Indian River Inlet.....	Del.	North of inlet.
Bethany Beach.....	Del.	$6\frac{1}{4}$ miles north of Fenwick light.
Fenwick Island.....	Del.	$1\frac{1}{2}$ miles north of light.
Isle of Wight.....	Md.	$3\frac{1}{2}$ miles south of Fenwick light.
Ocean City.....	Md.	At village.
North Beach.....	Md.	10 miles south of Ocean City.
Green Run Inlet.....	Md.	$13\frac{1}{4}$ miles northeast of Assateague light.
Popes Island.....	Va.	10 miles northeast of Assateague light.
Assateague Beach.....	Va.	On Fishing Point, $3\frac{1}{4}$ miles south-southwest of Assateague light.
Wallops Beach.....	Va.	$1\frac{1}{4}$ miles south of Chincoteague Inlet.
Metomkin Inlet.....	Va.	On Metomkin Beach north of the inlet.
Wachapreague.....	Va.	South end of Cedar Island.
Parramore Beach.....	Va.	Midway of beach.
Hog Island.....	Va.	South end of Hog Island.
Cobb Island.....	Va.	South end of Cobb Island.
Smith Island.....	Va.	At Cape Charles light (old tower).
Cape Henry.....	Va.	$\frac{3}{4}$ mile southeast of Cape Henry light.

VARIATION OF THE COMPASS.

The magnetic variations for 1924 and annual increase at points mentioned are as follows:

Locality.	Variation west.	Annual increase.
Sandy Hook.....	10 20	4
Atlantic City.....	8 50	4
Overfalls light vessel.....	7 50	4
Ship John Shoal lighthouse.....	8 00	4
Reedy Island.....	8 05	4
Philadelphia.....	8 55	4
Winter Quarter Shoal light vessel.....	7 20	4
Cape Charles light vessel.....	6 20	4
Hampton Roads.....	5 50	4
Richmond.....	5 20	4
Wolf Trap lighthouse.....	6 10	4
West Point.....	5 45	4
Pocomoke Sound.....	6 40	4
Vienna.....	7 00	4
Potomac River entrance.....	6 20	4
Washington.....	6 25	4
Cambridge.....	7 00	4
Bloody Point Bar lighthouse.....	7 00	4
Baltimore Harbor.....	7 10	4
Havre de Grace.....	7 45	4

TIDES.

Locality.	Lunitidal interval, high water. ¹	Mean range.	Lowest tide.
	<i>h. m.</i>	<i>Feet.</i>	<i>Feet.</i>
Sandy Hook.....	7 35	4.7	-4.0
Atlantic City, Million Dollar Pier.....	7 11	4.0	-3.0
Great Egg Inlet.....	7 36	4.1	-2.5
Delaware Breakwater.....	8 06	4.3	-2.5
Reedy Island.....	10 43	5.8	-3.5
Philadelphia.....	1 30	5.2	-3.5
Trenton.....	4 30	4.2	-3.0
Assateague Anchorage.....	7 20	4.0	-2.5
Franklin City.....	9 33	1.0	-2.5
Cape Henry lighthouse.....	8 00	2.8	-2.0
Old Point Comfort.....	8 44	2.5	-3.5
City Point, James River.....	2 21	2.8	-3.5
Richmond.....	4 18	3.7	-3.5
York Spit lighthouse.....	8 48	2.0	-3.0
West Point.....	10 47	2.9	-3.5
Stringray Point lighthouse.....	10 20	1.2	-2.5
Tappahannock.....	0 49	1.6	-3.5
Smith Point lighthouse.....	12 18	1.2	-3.0
Lower Cedar Point.....	2 24	1.4	-3.0
Washington.....	7 49	2.9	-4.0
Crisfield.....	0 23	1.9	-3.5
Cambridge.....	3 27	1.6	-3.5
Sandy Point lighthouse.....	5 05	0.8	-4.0
Baltimore Harbor.....	6 34	1.2	-4.5
Havre de Grace.....	9 15	2.1	-4.0
Chesapeake City.....	8 57	2.6	-4.0

¹ The mean lunitidal interval for high water is the average time from the meridian transit of the moon to the next following high water; it is also called the corrected establishment.

The effect of strong winds, in combination with the regular tidal action, may at times cause the water to fall below the plane of reference of the chart, mean low water; the lowest level observed below the plane of reference is given under the column headed "Lowest

tide." The water has been known also to rise about the same amounts above mean high water, due to similar causes.

Tide Tables for the Atlantic coast of the United States, including Canada and the West Indies, are published annually in advance by the United States Coast and Geodetic Survey. This volume furnishes, at the nominal cost of 15 cents, full tidal data for the Atlantic and Gulf coasts of North America.

It contains a table of full daily predictions of the times and heights of high and low waters for certain standard or principal ports along the coast; full explanations for the use of this table are given at the bottom of each page. The use of Table 2 of the tide tables should be known to every navigator. By means of this table the predictions given for the standard ports are extended so as to enable one to obtain complete tidal data for each day for stations only a few miles apart for the greater part of the coast and with almost the same accuracy as though full predictions were given for all of these points.

Instead of using the height differences of Table 2, however, a more accurate method is that of multiplying both high and low water heights at the standard port by the ratio of ranges for the given port to obtain the heights of the corresponding high and low waters. The ratio of ranges is given in tide tables. The minus sign before the predicted heights in the tide tables indicates that the water is below the plane of reference, which is mean low water.

The time of high or low water at any given port in Table 2 is found by taking the time of the corresponding tide for that day from the standard port for reference and applying to it the time difference for the given port from Table 2, adding it if the sign is plus and subtracting if minus.

INLAND WATERWAYS.

The following data about the inland waterways are included for ready reference:

The inland waters extending eastward from New York include Long Island Sound, Narragansett Bay, Buzzards Bay, and Vineyard and Nantucket Sounds. From the head of Buzzards Bay there is an available passage through Cape Cod Canal, from which the passage to the New England coast must be made mostly outside although there are harbors at short intervals.

Long Island Sound has harbors at short intervals on both sides from its west end to Eatons Neck, and thence on its north side to and including Fishers Island Sound. From Watch Hill boats must go outside to the bays and sounds eastward, but Point Judith Harbor of Refuge is available, and shortens the distance between harbors.

On the south coast of Long Island there is at present no inside route between Jamaica Bay and the inland waters eastward. Boats must go outside from New York to East Rockaway Inlet, and the latter requires local knowledge, because of frequent changes. But from East Rockaway Inlet boats of 5 feet draft can be taken inside through Great South Bay and 3 feet draft through Moriches and Shinnecock Bays and Shinnecock Canal to Great Peconic Bay. Masted boats are limited to a height of less than 20 feet above the water by the fixed bridges over Shinnecock Canal, and otherwise all bridges have draw

openings. This route is described in Coast Pilot, Section B, under the heading "Inland waters, south coast of Long Island."

By the Hudson River and Erie Canal boats can be taken from tidewater of the Hudson at Troy into the Great Lakes. There are 35 locks, and the distance from Troy to Tonawanda on the Niagara River is 290 miles. The controlling depth is 12 feet, and the usable lock dimensions are 300 feet long and 44 feet wide; the lifts range from 6 to 40½ feet. By the Hudson River and Champlain Canal vessels can be taken from tidewater of the Hudson River at Troy into Lake Champlain. There are 11 locks of the same dimensions as given for the Erie Canal. The principal ports on the lake are Port Henry, N. Y., near the south end; Burlington, Vt., and Plattsburgh, N. Y., near midlength; and Rouses Point, N. Y., near the international boundary. Vessels can pass from Lake Champlain into the St. Lawrence River, at Sorel, 30 miles below Montreal, through the Richelieu River and Chambly Canal. The limiting dimensions of the smallest lock are 118 feet (110 feet available), 22½ feet wide. The limiting depth is 6½ feet at low water. There are nine locks in the canal and one at St. Ours, 12 miles above Sorel. The total distance from Lake Champlain (international boundary) is 69 miles.

Charts may be obtained from the New York State Superintendent of Public Works, Albany, N. Y., covering the canals in New York State, and charts of the natural navigable waters embraced in the canal system may be had from the United States Lake Survey, Detroit, Mich.

The nearest inlet connecting with the inside waters on the coast of New Jersey is nearly 45 miles southward of Sandy Hook (Barnegat Inlet), and boats must pass outside between these points, unless taking the route through the Delaware & Raritan Canal. But from the head of Barnegat Bay to Cold Spring Inlet at Cape May there is an inside route for boats of 5 feet draft by taking advantage of the tide in places.

There is an inside route, good for small boats, 2½ feet draft at high water, along the coast of Delaware, Maryland, and Virginia, from Delaware Bay southward to Cape Charles.

New York to Key West.—Vessels of 7 feet draft can pass inside from New York Bay to Delaware River through the Delaware & Raritan Canal. Masted vessels are limited to a height of 50 feet above canal level by a bridge without draw at New Brunswick, N. J.

Vessels of 9 feet draft can pass inside from Delaware River to Beaufort, N. C., through the Chesapeake & Delaware Canal, Chesapeake Bay, Elizabeth River, Dismal Swamp Canal or Albemarle & Chesapeake Canal, Albermarle and Pamlico Sounds, Neuse River, Adams Creek, canal to Core Creek, and Newport River. Between Chesapeake Bay and Beaufort there is a minimum depth of 12 feet. A draft of 3 feet can be taken inside about 40 miles southward from Beaufort, N. C., to New River Inlet. All bridges have draw openings.

There is no inside passage from Beaufort, N. C., to Winyah Bay, a distance of about 160 nautical miles, and vessels must pass outside between these points. Cape Fear River, halfway between them, is available as a harbor.

Vessels of 5 feet draft can pass inside from Winyah Bay, S. C., to St. Johns River, Fla. All bridges have draw openings.

Vessels of 4 feet draft can pass inside from St. Johns River to Miami, Fla., through Pablo Creek, North Matanzas, Halifax, and Hillsborough Rivers, Mosquito Lagoon, Indian River, South Jupiter Narrows, Hobe and Jupiter Sounds, Lake Worth, Key Biscayne Bay, and the canals connecting them. All bridges have draw openings.

From Miami to Key West, Fla., there is practically an inside route through the Hawk Channel that can be used by vessels of 10 feet draft. Cuts with a depth of 5 feet have been made in places so that vessels of 4 feet draft can go from Miami through Key Biscayne Bay, Card Sound, Barnes Sound, railroad drawbridge at Cross Key, Blackwater Sound, Tarpon Basin, Florida Bay along the north side of the keys to Long Key, and thence northwestward into the Gulf of Mexico at Cape Sable, or can continue in Florida Bay along the north side of the keys, through Big Spanish Key Channel, and thence in the Gulf of Mexico to Key West.

Boats of 3 feet draft can be taken across Florida by way of North New River Canal, Lake Okeechobee, and Caloosahatchee River.

Gulf of Mexico.—From Key West to New Orleans there are several detached stretches of inside waters, available for a draft of 4 to 5 feet, and a partially sheltered route with frequent harbors for small craft along the entire coast.

From New Orleans westward through Louisiana there is a network of inside waters affording a through route, for drafts of 3 to 5 feet, to Sabine Pass. From Sabine Pass to Galveston there is no inside route.

From Galveston southwestward to Corpus Christi there is an inside route for a draft of 4 feet by way of several extensive bays and dredged canals connecting them. Beyond Corpus Christi there is no inside route available.

Charts covering the routes along the Atlantic coast and Gulf of Mexico are published by the United States Coast and Geodetic Survey.

A catalogue showing the charts of the route along the Atlantic and Gulf coasts can be obtained free of charge on application to the Coast and Geodetic Survey, Washington, D. C., or to any of its agents. A list of agents for the sale of charts and other publications of the Coast and Geodetic Survey is given in the catalogue and in the first notice each month of the Notice to Mariners, published weekly by the Bureau of Lighthouses and the Coast and Geodetic Survey.

The inland waters are covered in the following publications of the Coast and Geodetic Survey:

United States Coast Pilot, Section A, St. Croix River to Cape Cod.

United States Coast Pilot, Section B, covering the coast and inland waters from Cape Cod to Sandy Hook, including Long Island Sound, New York Harbor, and tributaries.

United States Coast Pilot, Section C (this volume), covering the coast and inland waters from Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays, and the inside route from New York to Norfolk.

Inside Route Pilot, coast of New Jersey.

United States Coast Pilot, Section D, covering the coast from Cape Henry to Key West and inland waters from Cape Henry to Beaufort, N. C.

Inside Route Pilot, New York to Key West.

United States Coast Pilot, Section E, covering the coast and inland waters of the Gulf of Mexico.

Inside Route Pilot, Key West to New Orleans.

Tide Tables, Atlantic coast ports of the United States.

CURRENTS, SANDY HOOK TO CAPE HENRY.

The following statements are deduced from current observations which have been made at all the light vessels along this section of the coast for about three months during the winter of 1912-13, and from other sources:

Tidal currents.—These are weekly rotary in character, revolving clockwise, with minimum velocities three hours after strength of flood and ebb in a direction at right angles to that at the time of strength. When not influenced by the larger bays or rivers, such as Delaware River, Chesapeake Bay, and New York Bay, these tidal currents are weak, averaging about 0.2 knot at strength, the direction of the flood and ebb at strength being on and off shore, respectively. In the immediate vicinity of the larger bays or rivers, the direction of flood and ebb at strength is directly in and out, and the strength of the current is increased, depending on the proximity of the mouth. These three rivers and bays affect the direction of the tidal currents to a distance of about 20 miles from their entrances, but the strength of the offshore current is not affected until within a few miles of the mouth.

Wind currents.—Moderate to heavy winds set up strong currents in a direction about 20° to the right of the wind, reversing or greatly accelerating the normal currents; in fact, the principal currents along this stretch of coast, when away from the larger bays, are the wind currents. Their strength and set depend on the direction, strength, and duration of the wind. The greatest observed velocities of the current at the light vessels are Ambrose Channel, 1.4 knots; Northeast End, 1.2 knots; Overfalls, 3.6 knots; Winter Quarter, 0.8 knot; Fenwick Island, 2 knots; Cape Charles, 1.6 knots; and Tail of the Horseshoe, 2.8 knots. These results are for three winter months, and probably closely approximate the maximum which might be expected.

Offshore currents.—Observations made offshore have developed the existence of weak tidal currents, veering around the compass, similar in character to those inshore, although of less strength. These are accompanied by a general drift in a southerly to southwesterly direction, amounting to about $\frac{1}{4}$ of a knot per hour; this extends from about the 20-fathom curve out nearly to the Gulf stream.

The following is a more detailed statement of the observations at each light vessel. The wind currents are of more importance than the tidal currents, and the two must be combined in making allowance for set.

Ambrose Channel light vessel.—The tidal currents have a mean velocity of 0.2 knot at strength of flood and ebb, the flood setting in a westerly and the ebb in an easterly direction. The strength of flood occurs 1 hour 20 minutes before time of high water at Sandy Hook, and the strength of ebb 1 hour 25 minutes before time of low water at Sandy Hook. Wind velocities of 10 to 25 miles produce currents of about 0.5 to 1 knot, setting about 20° to the right

of the wind. The greatest observed velocity of the current was 1.4 knots during a 50-mile-an-hour gale.

Northeast End Light Vessel.—The tidal currents have a mean velocity of 0.2 knot at strength of flood and ebb, the flood setting in a westerly and the ebb in an easterly direction. The strength of flood occurs about $1\frac{1}{2}$ hours after the current turns north in the entrance to Delaware Bay (or approximately 2 hours 35 minutes before time of high water at Sandy Hook), and the strength of ebb comes about $1\frac{1}{2}$ hours after the current turns south in the entrance to Delaware Bay (or approximately 2 hours 35 minutes before time of low water at Sandy Hook). Wind velocities of 10 to 30 miles produce currents of about 0.5 to 0.9 knot, setting about 20° to the right of the wind. This wind current must be combined with the tidal currents in making an allowance for set. The greatest observed velocity of the current was 1.2 knots during a 50-mile-an-hour gale.

Overfalls light vessel.—See Currents, Delaware Bay.

Fenwick Island Shoal Light Vessel.—The tidal currents have a mean velocity of 0.3 knot at strength of flood and ebb, the flood setting in a north-northwest (true) direction and the ebb in a south-southeast (true) direction. The strength of flood occurs about 3 hours after the current turns north in the entrance to Delaware Bay (or approximately 1 hour before time of high water at Sandy Hook), and the strength of ebb current comes about 3 hours after the current turns south in the entrance to Delaware Bay (or approximately 1 hour before time of low water at Sandy Hook). Wind velocities of 10 to 30 miles produce currents of about 0.5 to 1 knot, setting about 20° to the right of the wind, except that the greatest current in a westerly direction observed was 0.7 knot. This wind current must be combined with the tidal current in making an allowance for set. The greatest observed velocity of the current was 2 knots during a 60-mile-an-hour gale.

Winter Quarter Shoal Light Vessel.—The tidal currents have a mean velocity of 0.1 knot at strength of flood and ebb, the flood setting in a west-southwest (true) direction and the ebb in an east-northeast (true) direction, occurring 4 hours 30 minutes before time of high water and low water, respectively, at Sandy Hook. Wind velocities of 15 to 30 miles produce currents of about 0.3 to 0.6 knot, setting about 20° to the right of the wind. The greatest observed velocity of the current was 0.8 knot.

Cape Charles Light Vessel.—The tidal currents have a mean velocity of 0.3 knot at strength of flood and ebb, the flood setting in a westerly and the ebb in an easterly direction. The strength of flood occurs about one-half hour after the current has turned west in the entrance to Chesapeake Bay (or approximately 1 hour 10 minutes before time of high water at Sandy Hook or 2 hours 25 minutes before time of high water at Old Point Comfort); the strength of ebb occurs about 1 hour after the current turns east in the entrance to Chesapeake Bay (or approximately 1 hour before time of low water at Sandy Hook or 2 hours before time of low water at Old Point Comfort). Wind velocities of 10 to 25 miles produce currents of about 0.5 to 1 knot, setting about 20° to the right of the wind. The greatest observed velocity of the current was 1.6 knots in a 40-mile-an-hour gale.

Current tables, published annually in advance, give a great deal of useful information relative to currents along this coast and in Delaware and Chesapeake Bays. They are for sale at any of the sales agents or at the Coast and Geodetic Survey Office, Washington, D. C.; price, 10 cents.

DIRECTIONS, NEW YORK TO CHESAPEAKE BAY ENTRANCE.

A description of the coast and outlying shoals from Sandy Hook to Cape May is given on page 30, and from Cape Henlopen to Cape Charles on page 76.

General remarks.—From Sandy Hook southward to Brigantine Shoal, a distance of about 70 miles, the coast is comparatively free from off-lying shoals, but southward of this point the coast is fringed with extensive areas of broken ground, depths of 10 fathoms and less being found at distances of nearly 20 miles offshore in places.

Owing to the numerous outlying shoals this coast is a dangerous one for deep-draft vessels, and unless sure of the vessel's position the lead should be used to give warning of too close an approach from seaward. The 15-fathom curve extends from 15 to 20 miles offshore northward of Winter Quarter Shoal light vessel and 20 to 25 miles offshore southward, and in thick weather vessels should keep outside this depth. The water shoals quite regularly from 30 fathoms to 15 fathoms, but inshore of the latter depth the soundings are irregular, and shoals rise abruptly in many cases from about 10 fathoms of water. In case one of the lights or light vessels are not made when in a depth of 15 fathoms it is advisable to stand alongshore until one of them is sighted.

Standing along the coast, vessels of the deepest draft usually pass outside of the light vessels and out of sight of land, except between Northeast End light vessel and New York. At night, if on this track, some of the lighthouses and the light vessels will be sighted, so that the vessel's position can be readily determined. The large number of sailing vessels, steamers, and tows passing up and down this coast make it necessary to keep a bright lookout to prevent collisions.

The routes followed by vessels along this part of the coast vary greatly, according to their draft and the condition of wind and weather. Complete directions to meet all conditions can not be given, but the following suggestions may be of some assistance to strangers.

Vessels of the deepest draft should in all cases keep outside of the light vessels and should, wherever possible, avoid crossing areas of a less charted depth than about 9 fathoms. The following courses lead in a least depth of about 9 fathoms, except in approaching the entrance to Chesapeake Bay, where they lead across a least depth of 7 fathoms, but close to 6-fathom spots.

From Ambrose Channel light vessel steer 186° true (S. by W. $\frac{1}{2}$ W. mag.) for 43 miles, to a position 8 miles off Barnegat lighthouse, bearing 276° true (WNW. $\frac{1}{2}$ W. mag.). Then steer 203° true (SSW. $\frac{7}{8}$ W. mag.) for 119 miles to a position $\frac{1}{2}$ mile eastward of Winter Quarter Shoal light vessel, passing 5 miles outside Brigantine Shoal gas and whistling buoy, $5\frac{1}{2}$ miles outside Northeast End light vessel, 5 miles outside Five Fathom Bank light vessel, and 5 miles outside Fenwick Island Shoal light vessel. From here a 213° true (SW.

$\frac{1}{2}$ S. mag.) course for 75 miles will lead $3\frac{1}{2}$ miles southeastward of Cape Charles light vessel and to a position 3 miles eastward of Chesapeake Bay entrance gas, whistling, and submarine bell buoy. The last course, if closely followed, leads over a least found depth of 42 feet, but leads 2 miles southeastward of 36-foot depths about 10 miles northeastward of Cape Charles light vessel, and the light vessel should not be passed closer than 3 miles. The last 5 miles of the course leads between shoals of 33 to 36 feet depth; care should be taken not to make the entrance buoy anywhere on the port bow on this course, and not to make it more than 4 miles to the eastward unless passing well outside.

Many large vessels entering Chesapeake Bay from northward run from Winter Quarter Shoal light vessel to Cape Charles light vessel, thence to Cape Henry gas and whistling buoy. The least found depth crossed on these courses is 34 feet.

Coasting vessels of 17 to 24 feet draft and the largest tows, except those trading between Delaware Bay and points northward, usually keep outside the light vessels.

The following courses represent approximately the mean of the courses followed by vessels of this class. They are varied but little on account of weather conditions except northward of Five Fathom Bank, where courses leading farther offshore are sometimes followed during easterly weather and closer inshore during westerly weather. These courses depend entirely on making the aids, and the lead is of little use to insure safety; in thick weather it is safer to keep farther offshore between Five Fathom Bank and Sandy Hook and exercise care to keep outside of the buoy off Barnegat.

	Course.		Distance in nautical miles.
	True.	Magnetic.	
1. Gedney Channel gas and whistling buoy to Barnegat Shoal gas, whistling, and submarine bell buoy. This course leads $\frac{3}{4}$ mile eastward of Shrewsbury Rocks gas and bell buoy and $3\frac{1}{4}$ miles eastward of Sea Girt light-house. Or, from Scotland light vessel a 187° true (S. by W. $\frac{1}{4}$ W. mag.) course will lead $\frac{3}{4}$ mile westward of Shrewsbury Rocks gas and bell buoy and to Barnegat Shoal gas, whistling, and submarine bell buoy.	188	S. by W. $\frac{1}{4}$ W.	44
2. To 2 miles eastward of Five Fathom Bank light vessel..... This course leads $1\frac{1}{4}$ miles eastward of Brigantine Shoal gas and whistling buoy and 2 miles eastward of Northeast End light vessel.	202	SSW. $\frac{3}{8}$ W.	63
3. To $\frac{1}{2}$ mile eastward of Fenwick Island Shoal light vessel... For vessels bound to or from Delaware Bay, a 272° true (W. $\frac{3}{8}$ N. mag.) course from Five Fathom Bank light vessel will lead to Overfalls light vessel, or a 152° true (S. by E. $\frac{3}{4}$ E. mag.) course from Overfalls light vessel will lead to Fenwick Island Shoal light vessel.	204	SSW. $\frac{3}{8}$ W.	$24\frac{1}{2}$
4. To $\frac{3}{4}$ mile eastward of Winter Quarter Shoal light vessel.....	195	SSW.	31
5. To $\frac{3}{4}$ mile southeastward of Cape Charles light vessel.....	216	SW. $\frac{1}{4}$ S.	62
6. To Cape Henry gas and whistling buoy.....	232	SW. by W. $\frac{1}{4}$ W. ..	$14\frac{1}{2}$

Tows and other local vessels of less than 17 feet draft usually pass inside of Five Fathom Bank and Fenwick Island Shoal at all times, and inside of McCrie Shoal and Winter Quarter Shoal, except in

easterly weather. The route most often followed both northward and southward in good weather by vessels with local knowledge is as follows: From the outer end of Ambrose Channel or from Scotland light vessel to $\frac{1}{2}$ mile westward of Shrewsbury Rocks gas and bell buoy; thence to Barnegat Shoal gas, whistling, and submarine bell buoy; thence to Brigantine Shoal gas and whistling buoy; thence to 1 mile northwestward of McCrie Shoal gas and whistling buoy; thence to Overfalls light vessel; thence to close eastward of Little Gull Bank gas and whistling buoy; thence to close eastward of Black Fish Bank gas and whistling buoy; thence to close eastward of Cape Charles light vessel; thence to Tail of the Horseshoe gas and bell buoy.

The course from Overfalls light vessel to Little Gull Bank gas and whistling buoy leads close to least found depths of $3\frac{1}{4}$ to 4 fathoms, and also leads through an area of possible fish traps. Strangers are advised to follow a more easterly course and to pass from $\frac{1}{2}$ to 2 miles westward of Fenwick Island Shoal whistling buoy. The course from Little Gull Bank gas and whistling buoy to Black Fish Bank gas and whistling buoy crosses Black Fish Bank where the depths are 18 to 20 feet. The course from Black Fish Bank gas and whistling buoy to Cape Charles light vessel leads close eastward of Parramore Banks, marked by a gas and whistling buoy, on which the least found depth is 21 feet.

In westerly or northwesterly weather vessels of this class bound northward run closer inshore in places. The generally used route for vessels with local knowledge is as follows: From Cape Charles light vessel to Great Machipongo Inlet bell buoy; thence along shore at a distance of about 3 miles to Assateague Anchorage; the outer limit of possible fish traps is 3 to $3\frac{1}{2}$ miles from shore. Tows and small coasting vessels bound northward usually anchor in Assateague Anchorage in heavy weather.

Bound northward from Assateague Anchorage, the generally used route of coasting vessels in good weather is to pass southward of Turners Lump gas and bell buoy and between Black Fish Bank and Chincoteague Shoals. In easterly weather they usually pass southward and eastward of Black Fish Bank. In westerly weather they often pass $\frac{1}{4}$ mile southward of the two red buoys marking the southern edge of Ship Shoal and then follow the channel westward of Chincoteague Shoals; this channel has a least depth of 16 feet.

Between the northern end of Chincoteague Shoals and Little Gull Bank, vessels with local knowledge follow the shore close in in westerly weather, but always pass outside of Little Gull Bank. Between Little Gull Bank and Barnegat Inlet the ordinary courses are varied but little during westerly weather, but from Barnegat Inlet to Shrewsbury Rocks they follow the shore close in, not more than 1 mile off, but always pass outside of Shrewsbury Rocks can buoy.

In easterly weather the route often used by vessels of this class is from Cape Charles light vessel to Winter Quarter Shoal gas and whistling buoy; thence to 1 mile westward of Fenwick Island Shoal gas and whistling buoy; thence to 1 mile eastward of McCrie Shoal gas and whistling buoy; thence to Brigantine Shoal gas and whistling buoy; thence to Barnegat Shoal gas, whistling, and submarine bell buoy; and thence to Scotland light vessel. This route is also some-

times used by vessels bound southward in heavy easterly weather. The least found depth crossed is about 27 feet.

The following courses are suggested for strangers of 15 feet or less draft in good weather. In bad weather or with a deeper draft, follow the directions for vessels of 17 to 24 feet draft, preceding.

	Course.		Distance in nautical miles.
	True.	Magnetic.	
1. Gedney Channel gas and whistling buoy to Barnegat Shoal gas, whistling, and submarine bell buoy. This course leads $\frac{3}{4}$ mile eastward of Shrewsbury Rocks gas and bell buoy. Or, from Scotland light vessel a 187° true (S. by W. $\frac{1}{2}$ W. mag.) course will lead $\frac{3}{4}$ mile westward of Shrewsbury Rocks gas and bell buoy and to Barnegat Shoal gas, whistling, and submarine bell buoy.	188	S. by W $\frac{1}{2}$ W....	44
2. To Brigantine Shoal gas and whistling buoy.....	205	SW. by S.....	24 $\frac{1}{4}$
3. To 1 mile northwestward of McCrie Shoal gas and whistling buoy. The course leads 2 miles southeastward of Hereford Inlet whistle buoy and 3 $\frac{3}{4}$ miles eastward of Hereford Inlet light-house.	222	SW. $\frac{1}{2}$ W.....	43
4. To Overfalls light vessel.....	244	WSW. $\frac{3}{8}$ W.....	8 $\frac{3}{4}$
5. To 1 mile westward of Fenwick Island Shoal gas and whistling buoy.	173	S.....	21
6. To Little Gull Bank gas and whistling buoy.....	197	SSW. $\frac{1}{8}$ W.....	9 $\frac{1}{4}$
7. To 1 mile westward of Black Fish Bank gas and whistling buoy. The course leads close to a perpendicularly striped gas buoy.	204	SSW. $\frac{1}{4}$ W.....	30
8. To $\frac{1}{2}$ mile westward of Cape Charles light vessel..... This course leads close to Parramore Banks gas and whistling buoy.	204	SSW. $\frac{3}{4}$ W.....	50 $\frac{1}{2}$
9. To Tail of the Horseshoe gas and bell buoy.....	245	WSW. $\frac{1}{4}$ W.....	15

COAST FROM SANDY HOOK TO CAPE MAY.

The coast of New Jersey has a general south-southwesterly trend for 43 miles from Sandy Hook to Barnegat Inlet, and then a southwesterly trend for 67 miles to Cape May Point. The coast from Sandy Hook southward to Corson Inlet is free from dangers if it be given a berth of 5 miles or more. From Corson Inlet southwestward to Cape May there are shoals with a least depth of 15 feet extending about 14 miles offshore, but with channels inside of them.

Shoals extend for a considerable distance off many of the inlets; all of the inlets are obstructed by shifting bars and require local knowledge to carry the best water. The principal ones, with their approximate depths, are: Barnegat Inlet, depth 7 feet in a narrow crooked channel; Little Egg Inlet, depth 4 feet; Absecon Inlet, depth 15 feet; Great Egg Inlet, depth 7 feet; and Cold Spring Inlet, depth 18 feet. The most favorable time for entering the inlets is on a flood tide with a smooth sea; in easterly gales or in a heavy sea they can not be entered in safety.

New York Bay, including Navesink and Shrewsbury Rivers, is described in Coast Pilot, Section B, Cape Cod to Sandy Hook.

Sandy Hook, the northern point of the New Jersey coast, is a low sand spit. On the north end are a fort, some houses, Sandy Hook

lighthouse, a Coast Guard station, and a storm warning display station. Near the fort is a vessel reporting station from which vessels are reported to the Maritime Exchange in New York City.

Sandy Hook lighthouse is a white stone tower. The light is fixed white, 88 feet above the water, and visible 15 miles.

Sandy Hook Point light is on the northwest end of the point. The light is fixed white with a vertical beam. A fog bell sounds 1 stroke every 10 seconds.

Navesink Highlands is a prominent high wooded ridge 5 miles southward of the north end of Sandy Hook, on the side of which, in a cleared space, is Navesink lighthouse. The latter consists of two brownstone towers connected by a dwelling. The light, shown from the south tower, is flashing white of high power (light 0.3 second, eclipse 4.7 seconds), 246 feet above the water, and visible 22 miles. In case of accidental extinguishment of the flashing light, a fixed white light will be shown from the north tower.

There is practically continuous line of summer resorts along the coast from Navesink Highlands southward to Bay Head. The following are the names of the most important, with their distances southward of Navesink lighthouse: **Seabright**, 2 miles; **Long Branch**, 6 miles; **Asbury Park**, 10½ miles; **Ocean Grove**, 11 miles; **Bradley Beach**, 12 miles; **Belmar** (south side of Shark River Inlet), 13 miles; **Spring Lake**, 15 miles; **Sea Girt**, 16 miles; **Manasquan**, 17 miles; **Point Pleasant**, 19 miles; and **Bay Head**, 20 miles. Long Branch and Asbury Park are most conspicuous on account of the greater number of large buildings; Manasquan is marked by twin water tanks about 1 mile southwest of Sea Girt lighthouse; Point Pleasant by a stand-pipe, and Bay Head by a water tank with a conical top and bottom.

Shrewsbury Rocks, 3½ miles southward of Navesink lighthouse, extend 1¼ miles from shore, have a least depth of 15 feet, and are marked at the eastern end by a black can buoy and by a gas and bell buoy ⅞ mile farther eastward. From Shrewsbury Rocks southward to within 4 miles of Barnegat Inlet the coast is clear, and the 5-fathom curve lies nowhere more than ¾ mile from shore.

Shark River Inlet, 17 miles southward of Sandy Hook, has been improved by the State of New Jersey by the construction of retaining walls on both sides at the entrance and a curved jetty about 300 feet on the north side. There is a least depth of 1½ feet over the bar at mean low water, which is found in a narrow curving channel commencing just north of the first pier south of the entrance and heading toward the end of the jetty, thence following the curve of the jetty to the draw of the highway bridge just inside the entrance. In any but smooth weather breakers extend across the entrance. From west of the bridge to the second bridge the river is bulkheaded on the south side, with a launch basin midway. Most of the area is bare, or nearly so, at low water with a crooked channel sometimes marked by stakes. There are two fixed bridges crossing the river ¾ mile westward of the inlet, with a headroom of 4 to 5 feet and depth of 3 feet in the channel at high water. The river is frequented by small local yachts and fishing boats of about 2 feet draft. Gasoline and provisions can be had.

Sea Girt Inlet, just northward of Sea Girt lighthouse, is closed at low water, and is only occasionally used at high water and smooth sea by small fishing boats of 2 feet draft.

Sea Girt lighthouse, 16 miles south-southwestward of Navesink lighthouse, is a square brick tower in front of a dwelling. The light is flashing white (flash 0.3 second, eclipse 0.7 second), 52 feet above the water, and visible 13 miles. A radio fog signal sends 3 dashes for 30 seconds, silent 3 minutes, in thick or foggy weather.

Manasquan Inlet, 22 miles southward of Sandy Hook, has a narrow changeable entrance, with a depth across the bar in 1923 of about 2 feet, but it is sometimes almost entirely closed. It is not used except by small boats in case of necessity. The river has a general depth of 4 to 5 feet for $4\frac{1}{2}$ miles from the inlet and is navigable for small boats to Manasquan Park, about 7 miles from the inlet. It is frequented by fishing and pleasure boats of about 2 feet draft. Three drawbridges cross the river, the least width of span being 30 feet and least headroom 3 feet at high water. The range of tide inside is about 1 foot. A channel, 6 feet deep, to connect Manasquan River and Metedeconk River is being dredged. When completed this improvement will provide a northern approach to the inland waterways through Manasquan River.

There is an inland waterway from Bay Head southward to Cold Spring Inlet, good for a draft of 5 feet by taking advantage of high water at the shoal places. The beaches separating the inside waters from the ocean are low, and the summer resorts are more widely separated than those northward. To vessels bound southward along the coast the first landmark southward of Bay Head is the town of **Mantoloking**, a large group of houses with a water tank showing only a little above the buildings. Southward of this are **Chadwick** and **Lavallette**, small groups of houses without prominent marks, and a hotel at **Ortley**. About 1 mile southward of Ortley is **Seaside Heights**, a town with a tank at the north end, and $1\frac{1}{2}$ miles farther south is **Seaside Park**, marked by two water tanks at the south end. There is a small group of houses around Island Beach Coast Guard station, $1\frac{1}{4}$ miles southward of Seaside Park, and from there to Barnegat Inlet, a distance of about $7\frac{1}{2}$ miles, the only marks are the Coast Guard stations.

In the vicinity of Barnegat Inlet shoals with depths less than 5 fathoms extend 2 miles offshore and form a menace to navigation, especially to vessels bound northward along the coast in thick weather. There is a gas, whistling, and submarine bell buoy 4 miles east-southeastward of Barnegat lighthouse.

Barnegat lighthouse, the most prominent mark in the vicinity of Barnegat Inlet, is a conical tower, lower half white, upper half red. The light is flashing white (flash 2.5 seconds, eclipse 7.5 seconds), 163 feet above the water, and visible 19 miles.

Barnegat Inlet, marked on the south side by Barnegat lighthouse, had a depth across the bar in 1923 of about 7 feet in a narrow, crooked channel. The deepest draft taken across the bar is about 7 feet at high water. The channel is marked by perpendicularly striped buoys which are intervisible, but is subject to change both in depth and position, and the buoys can not always be depended upon to mark the best water. Strangers usually take a pilot, either picking up a fisherman outside or setting signal and waiting for one from Barnegat City. With a smooth sea, it is usually safe for boats of 3 to 4 feet draft to enter by following the buoys.

Barnegat Inlet has been moving slowly southward for many years. The successive surveys show the channel leading across the bar to the point of the beach on the north side of the inlet, and then across to the lighthouse. Inside the inlet the channels are more stable, and there is good anchorage in the channel westward of the lighthouse. From the inlet the principal inside channel, which is buoyed and has a least depth of about 7 feet, leads westward and northward, as shown on the chart, until westward of Sedge Island, and then through Oyster Creek Channel. Local boats bound to Barnegat or southward usually leave the buoyed channel about midway between Clam and Sedge Islands and follow the slough westward and southwestward toward the mouth of Double Creek. It is marked by bush stakes, but strangers should not attempt to run it. There are no channels from the inlet southward between the islands except for small boats at high water.

Barnegat Bay and the bays and connecting channels southward form a continuous inside waterway from Bay Head to Cold Spring Inlet. The inside waters are entered from seaward by a number of inlets with shifting entrances, in most cases marked by buoys. The inlets and interior waters give access to the large number of summer resorts along the beach and many villages on the mainland adjacent to them. They are used by many pleasure boats and boats engaged in the oyster and clam industry and inside and outside fishing. There is considerable passenger and general freight business between points inside, but little coasting trade. This waterway is fully described in *Inside Route Pilot, Coast of New Jersey*, published by this bureau, price 30 cents.

Lying $4\frac{1}{2}$ miles southwestward of Barnegat lighthouse is **Harvey Cedars**, a small settlement without prominent marks, north of which is High Point, marked by a green water tank; about 2 miles farther southwestward is **Surf City**, marked by a black water tank. Southwestward of this are several small settlements with water tanks, and 14 miles southwestward of Barnegat lighthouse is **Beach Haven**, a large town marked by a large water tank. There is a small group of houses around Bond Coast Guard station, $11\frac{1}{2}$ miles southwestward of Beach Haven, and another group around Tucker Beach lighthouse, $21\frac{1}{2}$ miles farther southwestward.

A new inlet has broken through the beach $21\frac{1}{2}$ miles southward of Beach Haven, and this inlet must not be confused with Little Egg Inlet to the southward. In 1923 there was 8 feet over the bar. There is broken ground along the shore between Barnegat and Little Egg Inlets, and it should be given a berth of 3 miles or more to insure a depth of 30 feet.

Tucker Beach lighthouse, 2 miles northward of Little Egg Inlet, is a black tower on a white dwelling. The light is fixed white with red flashes (fixed 15 seconds and 6 red flashes of 0.7 second duration every 30 seconds), 49 feet above the water, and visible 12 miles. Little Egg Inlet light is on the point of beach on the north side of Little Egg Inlet.

Little Egg Inlet, 2 miles southward of Tucker Beach lighthouse, had a depth of about 4 feet across the bar in 1923, and is used by fish steamers and many smaller schooners and motor boats. The shore and channels at the inlet are subject to rapid change. It is

marked by perpendicularly striped buoys, which are intervisible until inside the inlet, the outer buoy being a bell buoy. There are no regular pilots, but strangers can usually pick up a fisherman outside to act as a pilot, or can set signal and wait for one from the Coast Guard station. Breakers form all the way across the inlet only in very heavy weather. There is good anchorage in a depth of about 8 fathoms in the channel northward of Little Egg Inlet light.

From Little Egg Inlet to Absecon Inlet, a distance of 8 miles, there are no marks except the Coast Guard stations and scattered groups of houses. Broken ground extends nearly 5 miles offshore and is marked at its eastern end by Brigantine Shoal gas and whistling buoy, which lies 8 miles eastward of Absecon lighthouse and 5 miles from shore. There is a black can buoy about 3 miles westward of the gas buoy, marking the outer end of the 18-foot depth on the shoal.

Brigantine Inlet is 7 miles northeastward of Absecon lighthouse and 4 miles southwestward of Tucker Beach lighthouse. It is nearly bare at extreme low water and has 5 or 6 feet at high water. It is not buoyed, and the only boats using it are small local oyster and fishing boats, and then only with a smooth sea and on a rising tide. Strangers should not attempt to enter. The Coast Guard stations are the only marks. The several thoroughfares leading from Brigantine Inlet are shoal at their western ends, and can only be navigated by small boats at high water. Strangers should not enter them.

Absecon Inlet is marked on the south side by Absecon lighthouse and Atlantic City. There is a project to dredge an entrance channel 20 feet deep and 400 feet wide. In early 1924 the inlet was good for a depth of about 15 feet. The channel is marked by buoys, easily intervisible, to an anchorage in the channel between the casino at the north end of Atlantic City and the bend northwestward of Rum Point. The channel is subject to some change, but the buoys are usually maintained in the best water. The outer buoy is a perpendicularly striped bell buoy, $2\frac{1}{4}$ miles south-southeastward of Absecon light. The shore on the south side is protected from extensive change by artificial means.

Most of the business through Absecon Inlet is to Atlantic City, but there are some boats running to the town of Absecon and to points north and south on the line of the inland waterway. The deepest draft of boats entering the inlet are a few freight schooners drawing up to 8 feet, but they enter near high water. Strangers, unless of light draft, usually take a pilot, either picking up a fisherman outside or signaling for a pilot from shore. If of not more than 4 or 5 feet draft, they can enter with a smooth sea and on a rising tide by following the buoys, keeping well away from rough water. Breakers extend across the inlet in heavy weather.

Atlantic City is the largest resort on the Atlantic coast, and is frequented by many boats, both from outside and from points along the interior waterways. It has several railroad connections with the mainland, an electric road connecting it with Pleasantville, Somers Point, and Ocean City, and an electric road along the beach southward to Longport, where boat connections can be made to Ocean City and points southward.

The casino at the north end of Atlantic City has a long wharf westward of it, with a depth of 12 to 15 feet, inside of which is a

small basin with a depth of 2 to 4 feet, which is used only by fishing boats kept for hire.

Gardners Basin, a bulkheaded basin nearly $\frac{1}{2}$ mile long and 60 yards wide, has its entrance 500 yards westward of the casino. It has a depth of 8 feet in mid-channel to the head and is used by many motor boats. All boats make fast to the bulkheads, for which a small wharfage charge is made. All kinds of supplies are obtainable, and there are railways and machine shops.

Absecon lighthouse, showing above the buildings at Atlantic City, is a conical tower, lower and upper thirds yellow, middle third black. The light is fixed white, 165 feet above the water, and visible 19 miles. Storm warnings are displayed near the yacht club.

There are a standpipe and chimney close together at **Ventnor**, $3\frac{1}{2}$ miles southwestward of Absecon lighthouse, a standpipe at **South Atlantic City**, and a standpipe at **Longport**, on the north side of Great Egg Inlet.

Longport is a summer resort on the north side of Great Egg Inlet. It is connected with Ocean City in summer by a line of steamers and with Atlantic City by an electric railway along the beach. The generally used channel from Longport to Ocean City follows the regular inside route through Risley Channel and Broad Thorofare. With local knowledge, small boats sometimes cross the flats from Longport southwestward, close southward of the marsh, which is good for a draft of 4 or 5 feet at high water.

Great Egg Inlet, $7\frac{1}{2}$ miles southwestward of Absecon lighthouse, had a depth in 1923 of about 7 feet at low water in the buoyed channel across the bar. It is used by many yachts of 4 or 5 feet draft and local fishing and pleasure boats. The deepest draft entering is an occasional tugboat up to 9 or 10 feet draft. The shore line on the south side and the position of the channel are fairly stable, and the buoys usually mark the best water. Strangers of 4 or 5 feet draft do not usually take a pilot in smooth weather, but follow the buoys, preferably on a rising tide, being also guided by the appearance of the water. Pilots may usually be had from fishing boats outside, or from Ocean City in answer to signal. Breakers extend across the inlet in moderately heavy weather. In winter it is used only by a few fishermen, and is often rendered dangerous by floating ice.

Ocean City, a large summer resort on the south side of Great Egg Inlet, has railroad and electric road connections with the mainland and southward along the beach to Corson Inlet. The wharves are on the northwest side, $\frac{1}{2}$ to $1\frac{1}{2}$ miles southwestward of the inlet, and have depths of 6 to 12 feet at the ends. There are two launch basins. There are two prominent standpipes close together, with a low water tank between.

Corson Inlet, 6 miles southwestward of Ocean City, had a depth across the bar in 1923 of about 4 feet. It is buoyed and is only used by a few local fishing and pleasure boats up to 4 or 5 feet draft. The appearance of the water is the best guide, but the channel is subject to rapid change and is not recommended for a stranger.

South Ocean City extends along the beach without prominent marks, about 1 mile northward of Corson Inlet. It can only be reached by small boats at high water from westward.

Corson Inlet (Strathmere P. O.) is a village and railroad station on the south side of Corson Inlet. A red water tank is prominent.

The channel from Corson Inlet northward into Main Thorofare is bare at low water and is crossed by two bridges. It is seldom used. The main channel leads southwestward through three draw bridges at Strathmere, then southward of a marshy island and close along the south shore to the east side of Beach Thorofare; it then leads north-norwestward for the south point of the marsh, and follows it to Ben Hands and Upper Thorofare. A draft of about 5 feet can be carried from inside the inlet to this point.

Ludlam Beach light, at Sea Isle City, is exhibited from a skeleton tower and is not prominent by day. The light is flashing white (light 2 seconds, eclipse 3 seconds), with a flashing red sector westward of 356° true (N. $\frac{3}{8}$ E. mag.), 36 feet above the water, and visible 11 miles. Sea Isle City is further marked by a standpipe and stack close by.

There is a shoal with a depth of about 15 feet and marked by a horizontally striped nun buoy, about 3 miles southeastward of Ludlam Beach lighthouse. Broken ground, with a least found depth of 4 fathoms, extends about 3 miles east-northeastward from the buoy. There is deeper water inside these shoals but, on account of the broken bottom and abrupt changes in depth, vessels of greater draft than 15 feet should pass outside of them.

Townsend Inlet, 3 miles southwestward of Ludlam Beach lighthouse, had a depth across the bar in 1923 of about 4 feet. It is used by small fishing and pleasure boats and an occasional cruising yacht up to 5 feet draft, which only enter at high water and with a smooth sea. The channel and shore line are subject to considerable change and are moving southward at present. A railroad with a draw-bridge on the south side crosses the inlet just inside the mouth. The channel is marked by perpendicularly striped buoys, but strangers generally take a pilot.

The resorts, named in order, between Sea Isle City and Hereford Inlet are: **Avalon**, marked by a standpipe; **Peermont**, a small settlement without prominent marks; and the town of **Stone Harbor**, marked by a slender black standpipe with white top. There is a perpendicularly striped whistling buoy off Townsend Inlet, and a black whistling buoy off Hereford Inlet.

Hereford Inlet lighthouse, on the south side of Hereford Inlet, is a white tower on a dwelling. The light is group flashing white (flash 0.3 second, eclipse 3.4 seconds, flash 0.3 second, eclipse 11 seconds), with a flashing red sector westward of 226° true (SW. $\frac{3}{4}$ W. mag.), 53 feet above the water and visible 13 miles.

Hereford Inlet, 6 miles northeastward of Cold Spring Inlet, is subject to rapid change, and the buoys can not always be depended upon to lead in the best water. In 1923 there was a depth of about $2\frac{1}{2}$ feet in the buoyed channel. The deepest draft of the boats entering the inlet is 4 feet. In the entrance there are large areas bare at low water and usually having a sand ridge showing at high water. They are covered with marsh grass in summer. Breakers form across the inlet in heavy weather and on the shoals at all times, and the appearance of the water is the best guide in entering. The inlet is used by many fishing boats. Pilots can usually be obtained from fishing boats outside. Stone Harbor Life Saving Station is the only mark on the north side of the inlet. There are buildings on the south side all the way from Hereford Inlet to Turtle Gut Inlet

and several prominent marks. There is a slender black standpipe $\frac{1}{4}$ mile westward of the lighthouse.

North Wildwood, Wildwood, and Wildwood Crest are summer resorts on Five Mile Beach between Hereford and Turtle Gut Inlets. There are a water tank and a large standpipe close together at Wildwood and a slender one mentioned above near Hereford Inlet.

Turtle Gut Inlet is closed.

Cold Spring Inlet, $4\frac{1}{2}$ miles eastward of Cape May lighthouse, has been improved by building two parallel stone jetties 850 feet apart and dredging a channel 400 feet wide with a present depth of about 18 feet to Cold Spring Harbor inside. The channel is marked by buoys and a flashing white light near the end of the east jetty. In entering, favor the west jetty, on account of shoal water extending out from the east jetty.

Cold Spring Harbor has been improved by private enterprise under a project to create a basin about 500 acres with a depth of 30 to 40 feet. It is used by fish steamers and pilot boats that go to the fish wharf, where coal may be obtained, and by numerous motor boats that go up Cape Island Creek to a landing near the drawbridge. Gasoline and provisions may be obtained and there are railways for hauling out motor boats up to 30 tons. A large hangar and water tank on Sewall Point are prominent.

About 2 miles westward of Cold Spring Inlet is **Cape May**, a summer resort having several large and prominent hotels; and 2 miles westward of Cape May is the summer resort of Cape May Point, marked by Cape May lighthouse.

Cape May lighthouse is a gray tower; the light is flashing white (flash 5 seconds, eclipse 25 seconds), 165 feet above the water, and visible 19 miles.

Five Fathom Bank is an area of broken ground about 13 miles eastward of Cape May. It is about 9 miles long in a northerly and southerly direction inside the 5-fathom curve and about 2 miles wide, and there are detached shoal spots eastward and northward of it. The least depth found is 15 feet, lying 10 miles 133° true (SE. $\frac{1}{2}$ S. mag.) from Hereford Inlet lighthouse, and is marked on the northeast side by a horizontally striped nun buoy. There is a red nun buoy marking a 21-foot spot about $3\frac{1}{2}$ miles southward of the horizontally striped buoy. It is near the south end of the shoals and should be given a berth of $\frac{1}{2}$ mile or more when passing eastward and southward of it. A 15-foot spot has been reported at the northern end of Five Fathom Bank, $8\frac{1}{4}$ miles, 98° true (ESE. $\frac{1}{2}$ E. mag.) from Hereford Inlet lighthouse.

There is very broken ground, with 5 fathoms or less, and abrupt changes in depth, between Five Fathom Bank and Cape May, and there is broken ground extending to a distance of about 6 miles southward of Cold Spring Inlet and Cape May.

The **passage inside of Five Fathom Bank**, passing either eastward or westward of McCrie Shoal, is generally used by coasting vessels entering Delaware Bay from northward. In a heavy sea, vessels of a greater draft than 18 feet should pass outside of Five Fathom Bank, and this is also the safer course at all times for strangers in vessels of a greater draft than 18 feet.

Northeast End light vessel, about $6\frac{1}{2}$ miles eastward of the north end of Five Fathom Bank, has a red hull with "Northeast" on the

sides. It has two skeleton towers with square daymarks at the top of each, and a light above the daymark on the fore tower. The light is occulting white (light 1 second, eclipse 1 second), 49 feet above the water, and visible 12 miles. If the occulting light is extinguished a fixed white light will be shown from the fore tower. The fog signal is a siren (blast 4 seconds, silent 5 seconds, blast 4 seconds, silent 107 seconds). If the fog signal is disabled, a bell will be struck by hand. The submarine bell strikes "45" every 36 seconds.

Five Fathom Bank light vessel, about 4 miles southeastward of the south end of Five Fathom Bank, has a straw-colored hull with "Five Fathom" on the sides, and two masts with round daymarks and light at the head of each. The light is occulting white (light 4 seconds, eclipse 2 seconds), 50 feet above the water, and visible 12 miles. The fog signal is a whistle (blast 4 seconds, silent 56 seconds). A bell will be struck by hand if the whistle is disabled. The submarine bell strikes "42" every 28 seconds. If the occulting light is extinguished, a fixed white light will be shown from the main mast head.

McCrie Shoal, having a least depth of 17 feet, lies 7 miles 136° true (SE. $\frac{3}{4}$ S. mag.) from Cape May lighthouse. It is marked on the southeast side by a gas and whistling buoy. The shoals and channels southwestward of Cape May are described under "Delaware Bay, Eastern Side."

Tides.—The mean rise and fall of tide on the outside coast is about 4.6 feet.

Current information for the outside coast is given on page 25.

Fish weirs may be found along the seacoast between Sandy Hook and Island Beach Coast Guard station at distances between $\frac{1}{4}$ and $1\frac{1}{4}$ miles offshore, except in front of Coast Guard stations, where a belt $\frac{1}{2}$ mile wide inshore and $1\frac{1}{2}$ miles wide offshore must be left clear.

Fish weirs between Island Beach Coast Guard station and Cape May are limited to the following areas: Inside of a line $1\frac{1}{4}$ miles offshore between Island Beach Coast Guard station and Barnegat Inlet; inside of a line between points 2 miles south-southeastward of Barnegat lighthouse and $2\frac{5}{8}$ miles eastward of Tucker Beach lighthouse; inside of a line between points $1\frac{1}{4}$ miles offshore abreast Chelsea and $2\frac{3}{8}$ miles offshore abreast Stone Harbor Coast Guard station, Hereford Inlet; and within a distance of 2 miles off shore between Hereford and Turtle Gut Inlets. Belts approximately 2 miles wide at the inshore end and wider at the outer end are left clear in front of each inlet. Fish weirs are permitted on the shoalest part of Five Fathom Bank, in a belt 7 miles long north and south (true) and 2 miles wide; but a track with a least width of about 5 miles is left clear of fish weirs inside of Five Fathom Bank.

All fish weirs are required to be marked by fixed lights, a white light on the outer end and a red light on the inner end where navigation is possible inside of them.

Storm warnings of the United States Weather Bureau are displayed at Long Branch, Little Egg Coast Guard station, Atlantic City, Great Egg Coast Guard station, Avalon Coast Guard station, and Cape May Point Coast Guard station.

DELAWARE BAY AND RIVER

form the boundary between the State of New Jersey on the east and the States of Delaware and Pennsylvania on the west. They are the approach to the cities of Wilmington, Chester, Philadelphia, Camden, and Trenton, and to many smaller cities and towns, and they have a large trade carried both in foreign and domestic vessels. Philadelphia, one of the important ports of the United States, and Trenton, the head of navigation, are 88 and 116 miles, respectively, above the entrance. The main entrance near Cape Henlopen is available for vessels of any draft. (See "Channels," following.) Vessels of 7 feet draft can pass from New York Bay to Delaware Bay through the Delaware & Raritan Canal, and vessels of 9 feet draft can pass from Chesapeake Bay to Delaware River through the Chesapeake & Delaware Canal. The route from New York Bay through Delaware River to Chesapeake Bay is described under the heading "Inside route, New York to Norfolk," on page 229.

Delaware Bay is, properly speaking, only an expansion of the lower part of the Delaware River. The dividing line is 44 miles above the entrance and extends from a monument lying 300 yards northwestward of Liston Point to a monument lying eastward of the south point at the entrance of Hope Creek.

Except at the entrance, Delaware Bay is bordered on both sides by wide areas of marsh, and there are no towns of any size on its shores. Detailed descriptions of the shores and tributaries are given under the headings "Delaware Bay, eastern side," and "Delaware Bay, western side."

Channels.—The main entrance to the bay, which is used by deep-draft vessels and strangers, has a clear width of over $2\frac{1}{2}$ miles between Cape Henlopen and the shoals, which extend 7 miles southwestward from Cape May Point.

The bay is shoal along its eastern and western sides, and there are extensive shoal areas close to the main channel through the center of the bay, but a channel with a depth of 35 feet or more leads from the entrance to the lower end of the dredged channel near the head of the bay. The least width (about $\frac{1}{4}$ mile between the 30-foot curves) is abreast Elbow of Cross Ledge lighthouse. The channel is well marked by lighthouses and buoys, but strangers in deep-draft vessels should not attempt to enter by night.

Improvements are in progress to secure a channel 35 feet deep from that depth in Delaware Bay to Allegheny Avenue (upper end of Port Richmond), Philadelphia, 800 feet wide in the straight reaches, 1,200 feet wide at Bulkhead Bar, 1,000 feet wide in the other bends, and 1,000 feet wide from abreast Gloucester to Allegheny Avenue. The latest examinations show a depth of 30.6 feet or more on the center line throughout the entire length of the channel. In August, 1923, the steamship *Edward Lukenbach*, drawing 33 feet, passed out of the capes from Philadelphia.

There is a small rock area on the western side of Tinicum range opposite the upper end of Chester Island. The least depth over the rock within the channel limits is 32 feet at mean low water.

There are also shoal areas, composed partly of ledge rock, in the western half of the channel at the lower end of Chester range and at the upper end of Marcus Hook range. While there is no ledge

rock within the channel limits on either Marcus Hook or Chester ranges projecting above 30 feet mean low water, vessels drawing more than 26 feet should navigate the eastern half of the channel, which is clear of all obstructions to a depth of 30 feet or more at mean low water.

There is a dangerous rock area lying to the westward of the intersection of Marcus Hook and Chester ranges and between these ranges and the old Schooner Ledge range opposite the large slag pile of the Delaware Steel Works at Chester. The lower limit of this rock area is marked by a horizontally striped buoy, and deep-draft vessels should keep to the eastward at this point. The dredged channel is well marked by lighted ranges and buoys.

Anchorage.—Delaware Breakwater Harbor and Harbor of Refuge are among the important harbors of refuge on the Atlantic coast and are extensively used by all classes of vessels. (For description, see p. 50.)

Deep-draft vessels sometimes anchor in the vicinity of the main channel above Fourteen Foot Bank lighthouse. **Bombay Hook Roads** is the widened part of the channel of the bay between Ship John Shoal lighthouse and the entrance to the dredged channel, which was formerly used as an anchorage by sailing vessels while waiting for a favorable tide to cross Duck Creek Flats. Deep-draft vessels can anchor here, south of the Liston range, in 5 to 7 fathoms, soft bottom; the shoals rise abruptly in places on the sides of the channel, as shown on the chart.

In Delaware River there is good anchorage anywhere where the depth and bottom are suitable; in every case care must be taken not to anchor on or close to the ranges, nor in the dredged channels. The anchorages off Philadelphia are on the eastern side of the river from abreast Gloucester to Kaighn Point and on the east side of the channel abreast Petty Island. (See Greenwich Point and Port Richmond anchorages.) Anchorage limits are prescribed by regulation, as follows:

Marcus Hook Anchorage is on the southeast side of Marcus Hook range, between Marcus Hook and the lower end of Racoon Island.

Fort Mifflin Anchorage extends from the lower end of Fort Mifflin to a point south of the prolongation of the Horseshoe lower range and lies westward of the Schuylkill River range and Fort Mifflin Bar range.

League Island Anchorage is east of the mouth of Schuylkill River and north of the channel marked by the Horseshoe west group lower range and extends to a point opposite Broad Street (middle of League Island).

Greenwich Point Anchorage is east of the main ship channel between two anchorage buoys (being white with a black anchor painted thereon), located opposite (1) the lower coal pier at Greenwich Point, to mark the lower limit of anchorage, (2) Dickinson Street to mark the upper limit of anchorage; the latter buoy is off Kaighn Point.

Cooper Point Anchorage is in the channel between Cooper Point and Petty Island, so as not to interfere with vessels going to or from Cooper Creek.

Port Richmond Anchorage is east of the main ship channel, between the prolongation of lines drawn from the lower and upper ends of

Petty Island, and is marked by two anchorage buoys (being white with a black anchor painted thereon). Buoy No. 1 is placed off the lower end of Petty Island. Buoy No. 2 is placed off Petty Island opposite Pier G, Port Richmond, about midway of the anchorage. The anchorage ground extends from the head of Petty Island to a point 900 yards below buoy No. 1 and northward of Cooper Point.

War vessels of the United States and of foreign nations and pleasure yachts, with permission of the commissioners of navigation, may anchor in such location as not to interfere with the navigation of the river.

Vessels must not anchor at any place in the Schuylkill River, nor lie at any wharf in that river more than two abreast, without the permission of the commissioners of navigation.

Harbor and anchorage regulations are enforced by the board of commissioners of navigation, and masters are required to report to them (348 Bourse Building) within 24 hours after arrival and before leaving the port must report their clearance. The following are extracts from the regulations:

4. All vessels at anchor in the port of Philadelphia shall keep their sails furled during the night and regulation riding lights exhibited.

22. Vessels anchored in the harbor of the port of Philadelphia requiring the assistance of the police or fire boats shall display their national flag union down.

23. The signal for the commissioners of navigation's tender shall be the International Code letter "N" set in the rigging or hoisted in a conspicuous place, or three short blasts and one long blast of steam whistle, to be continued until answered.

Speed regulations.—1. Vessels shall not be worked or navigated in the Delaware River between the Point House Wharf and Pier G, Port Richmond, at a greater rate of speed than 8 nautical miles an hour, and such vessels shall navigate as far as practicable from the pierhead line. This rule will not apply to river craft when they are proceeding at more than 300 feet from the pierhead line.

2. Vessels shall not be worked or navigated in the Delaware River in front of the navy yard, between red buoy No. 44, off mouth of Schuylkill River, and red buoy No. 46, off Eagle Point, at a greater rate of speed than 12 nautical miles an hour.

3. Vessels passing craft anchored in the stream between Marcus Hook and Bristol, loading, discharging, or bunkering, shall not navigate at a greater rate of speed than 8 nautical miles an hour.

4. Vessels shall not be worked or navigated in the Delaware River off Chester or Marcus Hook at a greater rate of speed than 12 nautical miles an hour.

5. When vessels are moored to the ends of piers at Marcus Hook, lying parallel with the rivers, passing vessels shall not exceed a speed of 8 nautical miles an hour.

Regulations for passing dredges.—The following are extracts from regulations prescribed by the Secretary of War for Delaware River:

1. Steamers without tows passing the dredges shall not have a speed greater than 6 miles an hour, and their propelling machinery shall be stopped when immediately abreast of the dredges and while passing over the breast and quarter lines of the dredge.

Steamers with tows passing the dredges shall not have a speed greater than 6 miles an hour, and their propelling machinery shall be stopped while passing over the breast and quarter lines of the dredge; but they may start their propelling machinery if necessary between these lines.

3. Vessels drawing less than 12 feet of water must keep outside of the buoys marking the ends of mooring lines of dredges.

4. Vessels must not anchor on the ranges of stakes or other marks placed for the guidance of the dredges.

5. Vessels must not run over or disturb stakes or other marks placed for the guidance of dredges.

6. Dredges and operating plant in the prosecution of the work must not obstruct any part of the channel unnecessarily.

8. The breast and stern anchors of the dredges shall be marked or buoyed so as to be plainly visible to passing vessels.

9. While vessels in the channel are passing all lines running across the channel from the dredge on the passing side must be entirely slacked.

Pilotage is compulsory between Delaware Bay entrance and any point on Delaware Bay or River for all vessels except those employed in and licensed for the coasting trade or American vessels entirely loaded with coal mined in the United States, if spoken or offered the services of a pilot outside of a line drawn from Cape May lighthouse to Cape Henlopen lighthouse.

The fees for piloting between Delaware Bay entrance and the port of Philadelphia or any other place on Delaware River are as follows: Vessels of 12 feet or less draft, \$2 per $\frac{1}{2}$ foot; vessels of over 12 feet draft, \$2.50 per $\frac{1}{2}$ foot. An increase of 10 per cent over these fees is charged when a vessel is spoken east of Five Fathom Bank light vessel or north of Mereford Inlet lighthouse or south of Fenwick Island lighthouse, and a deduction of 10 per cent is made when a vessel is spoken inside of a line joining Cape May and Cape Henlopen lighthouses, but pilotage is not compulsory in the latter case: *Provided, however*, under the laws of Delaware, a vessel is not exempt until Brandywine Light bears east.

Every ship or vessel bound to the Delaware Breakwater for orders shall be obliged to receive a pilot, provided she is spoken or a pilot offers his services outside of a straight line drawn from Cape Henlopen light to Cape May light, and every ship or vessel bound to the Delaware Breakwater for orders shall pay pilotage fees as follows: A sum equal to half the pilotage to the port of Philadelphia, and she shall be obligated to receive a pilot and pay the same pilotage fees when outward bound from the breakwater, and if such ship or vessel, without discharging her pilot, proceed to the port of Philadelphia, or any other port or place on the Bay or River Delaware, only one full pilotage fee shall be paid, in addition to the fee for detention: *Provided, however*, That the pilot bringing such ship or vessel to the breakwater be there discharged, and if the ship or vessel afterwards proceeds to Philadelphia or any other port or place on the Bay or River Delaware she shall make the usual signal for a pilot and continue to make such signal until reaching Brandywine light, and if spoken by or offered the services of a duly licensed Pennsylvania pilot before reaching Brandywine light shall be obliged to employ such pilot and pay him the regular rates in addition to the fee paid for bringing her into the breakwater and for detention, if any.

Either Pennsylvania or Delaware pilots are taken to or from any point on Delaware Bay or River, and the fees in either case are the same. Both Pennsylvania and Delaware pilots will be found aboard one vessel, either a steamer or auxiliary schooner, which will be found cruising outside the entrance of the bay.

In case a pilot having charge of a vessel and whilst conducting said vessel be detained, either by order of the master, owner, or consignee, or by ice or any other unavoidable circumstance not personal to himself, he shall receive compensation for such detention

at the rate of \$3 per day for each and every day so detained, commencing at a period of 24 hours from the time the detention first occurred.

Vessels waiting in Delaware Breakwater for orders usually retain the pilot and pay him the detention fee.

Storm warnings of the United States Weather Bureau are displayed at Cape May Point Coast Guard station, Delaware Breakwater, Bivalve, Reedy Island, and on the Bourse Building, Philadelphia. A branch office of the Weather Bureau is maintained at the Bourse Building, Philadelphia, to serve marine interests.

Reporting stations.—Vessels are reported to the Maritime Exchange at Philadelphia, during either day or night, from reporting stations at Delaware Breakwater and Marcus Hook, and by day from reporting stations at Reedy Island and New Castle. During the ice season an auxiliary station is placed in commission at Gloucester, N. J. Messages can be exchanged by International Code with any of the stations during the day and with the Delaware Breakwater station by night by means of a flashing lamp and the Morse Code. Vessels passing in or out of Delaware Bay should display their signals between Overfalls light vessel and Harbor of Refuge lighthouse. The station will answer all signals with pennant by day and by one long flash, followed by one short flash, at night. The following suggestions are made when signaling by means of a flashing lamp:

1. All other lights in the vicinity of the flashing lamp should be obscured.

2. The flashing lamp should be kept continually pointed directly toward the station or vessel.

3. Care should be taken that proper regularity is observed in the length of the flashes and spaces, and that the spaces between the words are considerably longer than those between the letters.

4. Vessels should, if possible, avoid coming within the rays of a lighthouse while signaling.

5. When "Morsing" a vessel's name, it is desirable that the name be spelled in full.

A **United States Branch Hydrographic Office** is established in the Bourse Building, Philadelphia. Bulletins are posted here giving information of value to seamen, who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service.

A **time ball** is dropped daily at noon of the seventy-fifth meridian (5^h 0^m, Greenwich mean time) from a staff on the Bourse Building, Philadelphia.

Towboats will usually be found cruising in the river and bay or at Delaware Breakwater. Towboats to tow vessels or barges into the tributaries of Delaware River are usually engaged from Delaware City, Wilmington, or Philadelphia.

Vessels employing the city ice-breaker steamers for towing purposes when in the ice pay a fixed rate for such service.

Quarantine.—There are national quarantine stations at Delaware Breakwater and Reedy Island and a State quarantine station at Marcus Hook. At the Marcus Hook station, marked by a yellow

flag, vessels are boarded by both national and State quarantine officers in order to avoid delay, and all vessels subject to inspection are required to stop there until given pratique. Vessels will be inspected, if desired, by the national quarantine officer at Delaware Breakwater. Vessels with sickness on board should anchor in Harbor of Refuge until inspected.

Supplies.—Coal and fuel oil for large vessels can best be obtained at Philadelphia and Wilmington and for small steamers and tugs at these places and at Delaware City, Pigeon Point, and Chester. Water is obtainable at all of these places, and at half ebb tide the water in the river as far down as Chester is fresh enough for use in boilers. Gasoline and provisions are obtainable at all of the towns on the river and bay. Points near Delaware Bay where they are obtainable are Lewes, Bivalve, and Bowers, and at Bayside during the fishing season.

Repairs.—Repairs to the hulls and machinery of large vessels can be made at Philadelphia, Camden, Chester, and Wilmington, and to small vessels and motor boats at these places and at Essington, Pa., and Bivalve, Dorchester, and Greenwich Pier, N. J. Further information is given under the description of these places.

Freshets are of rare occurrence, except in the vicinity of Trenton, and unless accompanied with ice do not interfere with navigation.

Ice.—In ordinary winters there is usually sufficient ice in the bay and river to make it a source of care to sailing vessels. Thin ice has been known to form early in December between Chester and Philadelphia, but the heavier ice does not usually begin to run before January. The tidal currents keep the ice in motion, except where it packs in the narrower parts of the river, when it often forms an obstruction that requires the services of steam, and the ice boats, of which there are a number at Philadelphia, are employed in keeping these parts of the river open. The greatest danger encountered from the ice is at Ship John Shoal, just above Fort Delaware, off Deep Water Point, and at the Horseshoe; at these places the ice usually packs heavier than elsewhere. After the first part of March ice is rarely met with.

In severe winters navigation above Chester has occasionally been interrupted, but with the powerful steamers now employed in the foreign and coasting trade to Philadelphia the channel is kept navigable for steamers during the most severe winters. The greatest danger is to wooden sailing vessels, which if caught in the pack ice are set on the shoals, and if in the thin ice are liable to be cut through on the water line.

Further information concerning freshets and ice above Philadelphia is given on page 76.

Tides.—The mean rise and fall of tides is 4.3 feet at Delaware Breakwater Harbor, 5.1 feet at Brandywine Shoal lighthouse, 5.8 feet at Elbow of Cross Ledge lighthouse, 6 feet at Ship John Shoal lighthouse, 5.8 feet at Reedy Island, 5 feet at Marcus Hook, and 5.2 feet at Philadelphia. Tidal information for the tributaries is given under their descriptions. Full tidal information, including daily predictions for Philadelphia, is given in the Tide Tables for the Atlantic Coast of the United States.

CURRENTS, DELAWARE BAY AND RIVER.

The predicted times of slack water for every day in the year at Overfalls light vessel, Delaware Bay Entrance, are given in the Current Tables, Atlantic Coast, issued annually in advance by this survey. This publication contains time differences for slack water at about 500 stations and six current diagrams, including one for Delaware Bay and River.

Five Fathom Bank light vessel.—The tidal current is rotary, turning clockwise. The strength of the flood occurs about 2 hours after the current turns north at Overfalls light vessel and sets N. 70° W. with a velocity of 0.5 knot. The strength of the ebb occurs about 2 hours 30 minutes after the current turns south at Overfalls light vessel and sets S. 70° E. with a velocity of 0.6 knot. Currents of a knot or more occur only with strong winds.

Overfalls light vessel.—The times of all slack waters are predicted in the Current Tables, Atlantic Coast. The strength of the flood occurs about 3 hours after slack before flood and sets N. 50° W. with a velocity of 1.9 knots. The strength of the ebb occurs about 3 hours 15 minutes after slack before ebb and sets S. 50° E. with a velocity of 2 knots (or approximately slack water before the flood occurs 2 hours after time of low water at Sandy Hook and slack water before ebb occurs 2 hours after time of high water at Sandy Hook). Strong southeasterly winds increase the flood velocity and diminish that of the ebb, while strong northwesterly winds diminish the flood and increase the ebb velocity. The greatest observed velocity of the flood is 3.2 knots and of the ebb 3.6 knots.

Cape May Channel, near Cape May.—The slack before flood and ebb occurs about an hour before it slacks at Overfalls light vessel (or approximately 1 hour after times of low and high waters, respectively, at Sandy Hook). In the eastern angle of the bay, where it becomes broadest, along the shore slacks before flood and ebb occur nearly 2 hours before it slacks at Overfalls light vessel.

Main Ship Channel off Fourteen Foot Bank lighthouse.—The slacks before flood and ebb occur 10 minutes after slack water at Overfalls light vessel (or approximately 2 hours 50 minutes after times of high and low waters, respectively, at Sandy Hook). The strength of the flood sets N. 30° W. with a velocity of 2 knots, and the strength of the ebb sets S. 30° E. with a velocity of 2.1 knots.

Channel off Ship John Shoal.—The slacks before flood and ebb occur about 1 hour and 20 minutes after slack water at Overfalls light vessel (or approximately 3 hours after times of high and low waters, respectively, at Philadelphia). The strength of flood sets N. 35° W. with a velocity of 1.9 knots, and the strength of ebb sets S. 35° E. with a velocity of 2 knots.

Channel off Reedy Island.—The slacks before flood and ebb occur about 2 hours and 40 minutes after slack water at Overfalls light vessel (or approximately 2 hours before times of low and high waters, respectively, at Philadelphia). The strength of flood sets N. 15° E. with a velocity of 1.9 knots, and the strength of ebb sets S. 15° W. with a velocity of 2 knots.

Channel off New Castle.—The slacks before flood and ebb occur about 3 hours and 30 minutes after slack water at Overfalls light

vessel (or approximately 1 hour 20 minutes before times of low and high waters, respectively, at Philadelphia). The strength of the flood sets N. 40° E. with a velocity of 1.9 knots, and the strength of ebb sets S. 40° W. with a velocity of 2 knots.

Channel off Chester.—The slacks before flood and ebb occur about 4 hours and 50 minutes after slack water at Overfalls light vessel (or approximately 20 minutes before times of low and high waters, respectively, at Philadelphia). The strength of flood sets N. 50° E. with a velocity of 1.8 knots, and the strength of ebb sets S. 50° W. with a velocity of 1.9 knots.

Channel off Philadelphia.—The slacks before flood and ebb occur about 5 hours and 45 minutes after slack water at Overfalls light vessel (or approximately slack water before the flood occurs 40 minutes after the time of low water at Philadelphia, and slack water before the ebb occurs 1 hour 5 minutes after the time of high water at Philadelphia). The strength of flood sets northerly with a velocity of 1.8 knots, and the strength of ebb sets southerly with a velocity of 1.9 knots. Close to the docks, both on the Philadelphia and Camden sides of the channel, slack water occurs 20 to 30 minutes earlier than in midstream.

Channel off Burlington.—The slacks before flood and ebb occur about 6 hours and 30 minutes after slack water at Overfalls light vessel. The current sets with the channel, the flood having a velocity of 1.8 knots at its strength and the ebb 1.9 knots.

Above Philadelphia and for several miles below the city.—The time of slack water and the strength of currents are considerably influenced by freshets, which delay the time of slack before flood, advance the time of slack water before the ebb, and increase the strength of the ebb current. In the lower bay the currents are influenced similarly by winds.

GENERAL REMARKS, APPROACHES TO DELAWARE BAY.

Between the parallels of $38^{\circ} 15'$ N. and $39^{\circ} 15'$ N. the 100-fathom curve is from 75 to 90 miles offshore and the 30-fathom curve is about 25 miles closer in toward the shore, both having a general northeasterly and southwesterly trend. Inside the 30-fathom curve the water shoals gradually westward to the 20-fathom curve, but inside the latter curve the depths are somewhat irregular, and if uncertain of her position, especially in thick weather, a vessel, when inside of the 20-fathom curve, should approach the coast with care and in no case approach closer than in 12 fathoms until sure of her position. On a clear night the lights of the light vessels and light-houses should be made in time to prevent too close approach to the shore.

Vessels coming from southward and seaward in clear weather should shape a course so as to cross the meridian of $74^{\circ} 30'$ W. in latitude $38^{\circ} 45'$ N.; this will lead them within 5 miles of Five Fathom Bank light vessel. If uncertain of the longitude, soundings should be taken frequently and the water not shoaled to less than 20 fathoms until between the parallels of $38^{\circ} 40'$ N. and $38^{\circ} 50'$ N., and the entrance then be approached between those parallels.

In approaching the entrance from northward and seaward, when between the parallels of $39^{\circ} 15'$ N. and $38^{\circ} 40'$ N., soundings of 20

fathoms indicate a distance of 25 to 30 miles from shore. In clear weather a vessel standing westward on the parallel of $38^{\circ} 45' N.$ should make Five Fathom Bank light vessel before the depth is lessened to 15 fathoms. There are least found depths of 29 to 38 feet between latitude $38^{\circ} 39' N.$ and $38^{\circ} 42' N.$, and longitude $74^{\circ} 43' W.$ and $74^{\circ} 49' W.$

Entering from northward, the passage inside of Five Fathom Bank, eastward or westward of McCrie Shoal, is used by most of the coasting vessels of less than 24 feet draft. In a heavy sea vessels of a greater draft than 18 feet are advised to pass eastward of Five Fathom Bank, and this is the safest course at all times for strangers in vessels of a greater draft than 18 feet.

Entering from southward, coasting vessels of the deepest draft keep outside Fenwick Island Shoal light vessel. Vessels of 15 feet draft usually pass inside of Fenwick Island Shoal in good weather, but strangers should use this passage with caution.

DIRECTIONS, DELAWARE BAY AND RIVER TO PHILADELPHIA.

Directions for the outside coast and courses to Overfalls light vessel from northward and southward are given on page 27. Directions for Delaware Breakwater are given on page 50.

The channel is well marked by lighthouses and buoys to the entrance of the dredged channel and by lighted ranges and buoys above that point. The dredged channels are generally 800 feet wide in the straight reaches and 1,000 feet wide in the bends. The buoys marking the dredged channels are usually maintained on or close to the edge, and vessels on the ranges will usually pass them at a distance of 100 to 200 yards. Buoys marking each range are numbered separately, and each buoy bears the first letter of the range which it marks. The ranges do not all show well as day marks, but vessels will ordinarily have no trouble in running by the buoys except when ice is running, at which times the buoys may be dragged from their positions.

Shoaling is liable to take place at any time where the channel has been improved, but the channels are usually redredged as soon as the shoaling is found. In general, the bottom is soft and vessels, if on or close on the ranges, do not sustain damage from grounding, except near the intersection of the Marcus Hook and Chester ranges and near the intersection of the Chester and Tinicum ranges, where the bottom is rocky. At the shoalest places deep-draft vessels take advantage of the tide, which has a mean rise and fall of 5 to 6 feet between the entrance of the river and the wharves at Philadelphia, but during strong northerly winds the high and low waters may be as much as 2.5 to 3.5 feet lower than the mean.

It must be remembered that the channel in the river is being improved and that dredges may be found at work on or near any of the range lines. Directions for passing dredges are given on page 41.

At night a stranger may be confused by the lights of vessels at anchor near the channels, and strangers in deep-draft vessels are advised not to run. Red sectors are established in the lighthouses to cover the dangers on both sides of the channel from Overfalls light vessel to the entrance of the dredged channel and should be observed closely if running at night.

The following table gives the courses and distances from Overfalls light vessel to Philadelphia. They lead in a least depth of about 29 feet to the entrance of the dredged channel and in the dredged channel (least depth 30.6 feet in 1924) to Philadelphia. Local knowledge or a pilot is required to carry a greater depth than 29 feet through Delaware Bay at low water. Many cut-offs are possible for light-draft vessels, but strangers are advised to follow the main channel. (See p. 39 for the present condition of the channel.)

	Course.		Distance in nautical miles.
	True.	Magnetic.	
1. Overfalls light vessel to $\frac{1}{4}$ mile east-northeastward of Fourteen Foot Bank lighthouse.	336	N. by W. $\frac{1}{2}$ W....	16 $\frac{1}{4}$
This course leads for Miah Maull Shoal lighthouse, and passes $\frac{1}{4}$ mile eastward of Brown Shoal gas and bell buoy and $\frac{1}{4}$ mile westward of Brandywine Shoal lighthouse.			
2. To $\frac{1}{2}$ mile west-southwestward of Miah Maull Shoal lighthouse.	330	NNW.....	4 $\frac{3}{4}$
3. To 200 yards westward of Elbow of Cross Ledge lighthouse.	325	NNW. $\frac{3}{8}$ W.....	4 $\frac{3}{8}$
4. To 300 yards eastward of gas and bell buoy 17.	332	N. by W. $\frac{3}{4}$ W.....	11 $\frac{1}{2}$
5. With Elbow of Cross Ledge lighthouse astern to 300 yards westward of Ben Davis Point Shoal gas and bell buoy.	329	NNW. $\frac{1}{8}$ W.....	27 $\frac{1}{8}$
6. To gas and bell buoy 1B.	318	NW. by N.....	17
This course leads $\frac{3}{8}$ mile southwestward of Ship John Shoal lighthouse and along the dredged channel on Liston range ahead.			
7. On Baker range ahead to buoy 1R.	355	N. $\frac{1}{4}$ E.....	15 $\frac{1}{2}$
8. On Reedy Island range astern to gas buoys 2N.	15	NNE.....	4 $\frac{1}{2}$
9. On New Castle range ahead to position $\frac{1}{4}$ mile southwestward of gas buoy 2D.	334	N. by W. $\frac{5}{8}$ W....	4 $\frac{1}{2}$
10. To position on Deepwater Point range and $\frac{1}{4}$ mile about N. by W. (mag.) from gas buoy 2D.	9	N. by E. $\frac{1}{2}$ E....	3 $\frac{1}{2}$
11. On Deepwater Point range ahead to gas buoy 2C.	42	NE. $\frac{1}{4}$ E.....	3 $\frac{1}{4}$
12. On Cherry Island range ahead to buoy 2B.	17	NNE. $\frac{1}{4}$ E.....	4 $\frac{1}{4}$
13. On Bellevue range astern to gas buoy 2M.	35	NE. $\frac{1}{8}$ N.....	3
14. On Marcus Hook range astern to gas buoy 2C.	57	NE. by E. $\frac{3}{4}$ E.....	4 $\frac{1}{4}$
15. On Chester range ahead to gas buoy 2T.	51	NE. by E. $\frac{1}{8}$ E.....	21 $\frac{1}{2}$
16. On Tinicum range ahead to $\frac{1}{4}$ mile eastward of 3T.	92	E. $\frac{1}{8}$ S.....	31 $\frac{1}{2}$
17. Past Lincoln Park and Billingsport to buoy 1F.	70	E. by N.....	13 $\frac{1}{2}$
18. On Fort Mifflin Bar range astern to the gas and bell buoy 44 opposite the lower end of League Island.	54	NE. by E. $\frac{1}{2}$ E.....	2 $\frac{1}{4}$
19. On Horseshoe West Group lower range astern until on Eagle Point range.	94	ESE, $\frac{3}{8}$ E.....	17 $\frac{1}{2}$
20. On Eagle Point range astern until on Horseshoe East Group upper range.	60	ENE. $\frac{1}{8}$ E.....	1 $\frac{1}{2}$
31. On Horseshoe East Group upper range to abreast Gloucester.	26	NE. by N.....	7 $\frac{1}{8}$
The mid-channel is clear above Gloucester, but the best water favors the western side. Anchorages are described on p. 40.			

DELAWARE BAY, WESTERN SIDE.

The western shore of Delaware Bay is low and marshy, with few prominent marks northward of Delaware Breakwater. The principal marks visible from the western channel are as follows: A small group of houses at Waterloo, just above Broadkill River entrance; a group of houses at Slaughter Beach, just below Cedar Beach; the lighthouse and fish factory in the mouth of Mispillion River; a large group of houses at Bowers; a small group at Kitts Hummock; the lighthouse and a few houses at Mahon River; and the ranges at Leipsic River.

The rivers on the western side of Delaware Bay are very narrow and crooked, and vessels have considerable difficulty in making some of the turns. They are frequented by freight and passenger steamers and schooners carrying produce, fertilizer, and canned goods to or from the towns at their heads and the farm landings below, the usual draft of boats engaged in this trade being 6 to 8 feet. Oyster and fishing boats also seek anchorage in the mouths of many of them. Towboats are not often used, and strangers seldom enter.

Most of the business from the rivers is northward to Chester and Philadelphia. Local vessels usually take advantage of the tide up and down the Delaware River, leaving the mouths of the creeks bound northward at a little after low water, and leaving Philadelphia bound southward at high water or a little before. In entering or leaving the creeks allowance should be made for the current in the bay, which sets across the dredged channels and has considerable velocity at times.

There are many detached shoal spots with depths of 2 to 6 feet along the western side of Delaware Bay from Delaware Breakwater northward to Bombay Hook Point. They are generally unmarked, except in the vicinity of the main ship channel, and are subject to some change, both in depth and position. Strangers using any of the channels westward of the main ship channel should proceed with caution.

There is a channel along the western side of Delaware Bay which is marked by a line of perpendicularly striped buoys from off the mouth of St. Jones River southward to below Old Bare Shoal. It is used by most of the vessels frequenting the tributaries on the western side of the bay. It is said to lead clear of dangers if the buoys are followed closely, but leads close to the shoals in places.

Vessels entering the channel from northward usually leave the main channel of Delaware River at gas and bell buoy No. 21, $21\frac{1}{2}$ miles southward of Ship John Shoal lighthouse, pass close eastward of buoy No. 3, at the north end of Blake Channel, and steer 183° true (S. by W. mag.) to the buoy off the entrance of St. Jones and Murderkill Rivers. The northerly sector of Mahon River lighthouse covers the entrance to the channel at night. The least depth crossed on this course is 7 or 8 feet.

Cape Henlopen, on the southwest side of the entrance to Delaware Bay, is a high white sand hill, bare of vegetation. The point of the cape, from a comparison of the surveys, is moving northward at a slow but uniform rate. Vessels should keep in the white sector of Delaware Breakwater light when passing north of the cape. The most prominent mark is Cape Henlopen lighthouse, on the highest part of the hill. A shoal with little depth, as shown on the chart, extends nearly $\frac{3}{8}$ mile eastward from the end of Cape Henlopen, and is marked at its easterly end by a black bell buoy.

Cape Henlopen lighthouse is a white octagonal tower. The light is fixed white with a fixed red sector between 128° true (SE. mag.) and 173° true (S. mag.) 126 feet above the water, and visible 17 miles.

Delaware Breakwater (chart 379) is the name generally applied to the entire anchorage in the vicinity of Cape Henlopen, including the inner anchorage (Breakwater Harbor) and the outer anchorage (Harbor of Refuge).

Breakwater Harbor, on the west side of Cape Henlopen, southward of the inner breakwater, is easy of access both day and night and is a safe harbor for light draft vessels in all but heavy northwesterly gales, and affords considerable protection even in such weather. Under the most favorable conditions a vessel of as much as 15 feet draft can select anchorage with sufficient swinging room in the easterly part of the harbor, but the harbor is generally crowded in heavy weather, and vessels of a greater draft than about 10 feet should preferably anchor westward or northwestward of the inner breakwater or in Harbor of Refuge.

Breakwater Harbor has depths of 13 to about 30 feet in its easterly part, eastward of a line joining the reporting station on the breakwater and the easternmost fish-oil works. The angle in the westerly part of the breakwater is shoal, depths of 9 to 10 feet extend nearly $\frac{3}{8}$ mile south-southwestward from the westerly half of the breakwater, and depths of 12 to 13 feet extend to shore southwestward. The shoals with depths less than 12 feet on the south side of the harbor lie southward of a line joining the end of Cape Henlopen and the end of the Government pier, and inside the ends of the piers westward.

Pilots.—See page 42.

Tides.—The mean rise and fall of tides is about 4.3 feet.

Currents.—The tidal currents have considerable velocity behind the breakwater in the inner harbor, especially near its eastern end. The flood sets westward and the ebb eastward, and at strength have estimated velocities of $1\frac{1}{2}$ to 2 knots. Slack water before the flood occurs about 2 hours 20 minutes after time of low water at Sandy Hook and slack water before the ebb occurs about 2 hours after time of high water at Sandy Hook.

In the outer harbor the tidal currents have an average estimated velocity of 1 to $1\frac{1}{2}$ knots at strength. The general direction of tidal currents is about parallel with the breakwater, with a considerable set toward the lower end on the ebb and toward the upper end on the flood.

Directions, Breakwater Harbor.—From Overfalls light vessel steer 279° true (WNW. $\frac{1}{2}$ W. mag.) until Delaware Breakwater lighthouse bears about 240° true (WSW. mag.). Then steer this course for that lighthouse and pass about 100 yards southeastward of it in entering the harbor. The entrance is about $\frac{1}{4}$ mile wide between the lighthouse and the edge of the shoal southeastward. Caution is necessary at night during heavy weather on account of the large number of vessels which will usually be found at anchor in the harbor. Vessels should keep in the white sector of the Delaware Breakwater light when passing Cape Henlopen at night.

Coming down Delaware Bay, pass eastward of Brown Shoal gas and bell buoy, and steer 174° true (S. $\frac{1}{8}$ W. mag.) for Cape Henlopen lighthouse with Brandywine Shoal lighthouse astern, which will lead to a position 350 yards eastward of Harbor of Refuge lighthouse. A 203° true (SSW. $\frac{3}{4}$ W. mag.) course will then lead 100 yards eastward of Delaware Breakwater lighthouse.

Wharves.—The easterly wharf on the south side of Breakwater Harbor is the property of the Government, and has a depth of 16 feet at its end, but is in bad repair. Westward of it are wharves of fish-oil works, with about 12 feet at the ends, some of them in ruins.

and $1\frac{1}{4}$ miles westward is a railroad wharf with 12 feet at its end. Lying 500 feet westward of the latter are the submerged ruins of a wharf, which extend out nearly as far as the railroad wharf, and which should be carefully avoided.

Speed trial course.—A speed trial course is located east of the outer breakwater and is defined by range lines. The front objects are skeleton towers located on the outer breakwater; the southern rear object is a skeleton tower near the western end of the inner breakwater and the northern rear object is a skeleton tower on shore $1\frac{1}{2}$ miles west-northwestward of the railroad wharf at Lewes. Westward of the range tower is an old tower, formerly the Delaware Breakwater rear range light. The exact distance between the range lines is 1.000067 nautical miles on a course 319° true (northbound) or 139° true (southbound).

Lewes is a town with railroad communication lying $\frac{1}{2}$ mile southwestward of the railroad wharf. Provisions, gasoline, ice, and some ship chandlery are obtainable, and some coal in case of necessity.

The inner breakwater is nearly 1 mile long in a west-northwesterly direction, and is marked at its east end by Delaware Breakwater lighthouse, and at its west end by a red light. A telegraph and reporting station, from which vessels are reported to the Maritime Exchange at Philadelphia, is located near the middle of the breakwater, and storm warnings are displayed.

Delaware Breakwater lighthouse, on the east end of the inner breakwater, is a brown conical tower. The light is occulting white (light 2.5 seconds, eclipse 2.5 seconds), with an occulting red sector southward of 248° true (WSW. $\frac{3}{4}$ W. mag.) and 101° true (ESE. $\frac{3}{8}$ E. mag.), 61 feet above the water, and visible 13 miles. The fog signal is a horn, blast 2 seconds, silent 13 seconds. If the horn is disabled, a bell will be struck by hand 1 stroke every 10 seconds.

Lying westward and northwestward of the inner breakwater is an extensive anchorage with depths of 16 to 25 feet, muddy bottom, where vessels are sheltered from southeasterly and northeasterly winds, and this anchorage is much used by coasting vessels. The anchorage is easy of access, the least depths in the approach being 23 to 30 feet between the inner breakwater and Marshall Shoal red and black buoy.

Harbor of Refuge, lying 1 to 2 miles north-northwestward of Cape Henlopen, is formed by a breakwater which extends $1\frac{1}{4}$ miles south-southeastward from the southeast end of the Shears, and by a row of ice breakers on the Shears. The breakwater is marked 100 feet northward of its south end by Harbor of Refuge lighthouse, and at its north end by a red light. The harbor, except in its northern part, has depths of 4 to 7 fathoms, muddy bottom, for a distance of nearly 1 mile west-southwestward from the breakwater. It affords a harbor in easterly gales for deep-draft vessels. The entrance from southward is deep and clear, while that from northward across the Shears has depths of 9 to 12 feet. The deepest water, depths 5 to 7 fathoms, will be found $\frac{3}{8}$ mile westward of the south half of the breakwater. During seasons of ice drifting ice often forms a danger.

A ridge, having lumps with depths of 12 to 18 feet, extends 145° true (SSE. $\frac{1}{2}$ E. mag.) from the south end of the Shears toward

Delaware Breakwater lighthouse. The south end of the shoaler part of the ridge is marked by a horizontally striped buoy, which lies $1\frac{1}{8}$ miles 274° true (W. by N. mag.) from Harbor of Refuge lighthouse. **Marshall Shoal**, on the south part of the ridge, is marked by a horizontally striped buoy which lies $\frac{3}{8}$ mile north-northeastward of the angle in the inner breakwater. Depths of 23 feet have been found on the ridge for a distance of 600 yards south-southeastward from the latter buoy.

Directions, Harbor of Refuge.—From Overfalls light vessel a 282° true (WNW. $\frac{1}{4}$ W. mag.) course for $3\frac{1}{4}$ miles will lead nearly $\frac{1}{4}$ mile southward of Harbor of Refuge lighthouse. Coming down Delaware Bay, pass eastward of Brown Shoal gas and bell buoy and steer 174° true (S. $\frac{1}{8}$ W. mag.) for Cape Henlopen lighthouse with Brandywine Shoal lighthouse astern, which will lead to a position 350 yards eastward of Harbor of Refuge lighthouse. Pass 200 yards or more southward of the lighthouse when rounding it.

Harbor of Refuge lighthouse, on the breakwater, 100 feet from its south end, is a white dwelling on a brown pier. The light is flashing white (light 1 second, eclipse 11 seconds), with a flashing red sector between 330° true (NNW. mag.) and 341° true (N. by W. mag.), and some red tint on either side to 326° true (NNW. $\frac{3}{8}$ W. mag.) and 347° true (N. $\frac{1}{2}$ W. mag.), covering **Hen and Chickens Shoal**. The light is 61 feet above the water, and visible 13 miles. The fog signal is a siren, giving a group of three blasts, each of 2 seconds duration, every 60 seconds, silent interval 38 seconds. If siren be disabled, a bell will sound 1 stroke every 15 seconds.

Broadkill River empties into the Delaware River $3\frac{1}{2}$ miles north-westward of Lewes. A channel has been dredged 6 feet deep and 150 feet wide in the entrance, and the same depth and 40 feet wide to the town of **Milton**, the head of navigation, 10 miles above the mouth. A jetty, marked at its end by a beacon and a flashing white light, has been constructed on the northwest side at the mouth. The entrance is subject to rapid change. In 1923 there was a depth of $2\frac{1}{2}$ feet on the bar outside the entrance and about 5 feet to Milton. A drawbridge crosses the creek about 5 miles above the mouth. The draw has a clear width of 35 feet, a headroom at high water of about 4 feet when closed, and a depth of 6 feet in the opening.

Shoals extend about 300 yards offshore to the 6-foot curve, and are subject to change. The channel leads close to the jetty, and thence to the head the mid-channel is the best water, except for a middle ground, bare at a little below high water, which lies 1 mile above the mouth. The middle ground shows discolored water at all times, is usually marked by bush stakes, and the best water is on its south side.

The entrance to the canal which connects Delaware Bay with Rehoboth Bay is about $\frac{1}{2}$ mile inside the entrance of Broadkill River, and is described under the heading, "Inside waters, Cape Henlopen to Cape Charles."

Tides.—The mean rise and fall of tides is 4.6 feet at the entrance and 3.5 feet at Milton. High and low water at Milton occur 2 hours and 15 minutes later than at the entrance.

There are several drainage canals between Broadkill and Mispillion Rivers, which are used to some extent for purposes of navigation by small local boats, but they are of little interest to a stranger.

Mispillion River, 15 miles northwestward of Cape Henlopen lighthouse, is marked by Mispillion River lighthouse (a white tower on a dwelling flashing white with red sector), and by a fish factory just inside the mouth. A channel 4 feet deep and 150 feet wide has been dredged into the entrance, and 6 feet deep and 60 to 75 feet wide to the town of **Milford**, at the head of navigation 12 miles above the entrance. A long jetty has been constructed on the south side at the mouth and a short jetty on the north side. In 1923 there was a depth of about 5 feet across the bar at the entrance and thence $4\frac{1}{2}$ feet to Milford. The river is used by freight steamers, some schooners, and motor boats, the deepest draft being 7 feet.

Vessels bound into **Mispillion River** from northward steer southwestward from the gas buoy at the north end of Old Bare Shoal until off the dredged cut, and then follow the south jetty at a distance of 100 feet through the cut on a 310° true (NW. $\frac{1}{4}$ N. mag.) course for **Mispillion River lighthouse**. At night the southerly edge of the red sector leads to the entrance. From the inner end of the jetty the channel follows closely the south and west sides until above the lighthouse wharf and then follows a general mid-channel course to Milford, passing southward of the island lying 1 mile above the mouth. The channel is very crooked, and steamers have difficulty in making some of the turns.

Tides.—The mean rise and fall of tides is 5.1 feet at the entrance and 3.5 feet at Milford. High and low water at Milford occur 2 hours and 15 minutes later than at the entrance.

Murderkill River is $22\frac{1}{2}$ miles northwestward of Cape Henlopen lighthouse and 245° true (WSW. $\frac{1}{2}$ W. mag.) from Miah Maull Shoal lighthouse. A channel 7 feet deep and 100 feet wide has been dredged across the flats into the entrance, and 7 feet deep and 80 feet wide to the town of **Frederica**, at the head of navigation, 7 miles above the mouth. In 1923 the controlling depth at mean low water was $5\frac{1}{2}$ feet. The deepest draft ordinarily going to Frederica is about 7 feet. The river is extensively used by steamers and schooners to Frederica, and by fishing and oyster boats at the entrance. A passenger steamer runs to Philadelphia.

There is a lighted range for entering Murderkill River. The front range is a black post just above the steamer wharf, and shows against a low gray building with higher buildings on either side. There is a low iron chimney showing about 100 feet to the right of it. The back range is a white post 60 feet high with box on top, and shows well above the buildings at Bowers.

There is a mud bank along the south side of the entrance cut, which is bare for a considerable distance at low water, and was marked by bush stakes. There is a can buoy off the entrance, maintained at the intersection of the Murderkill and St. Jones River ranges.

To enter **Murderkill River**, from the can buoy head in on the range, course 247° true (WSW. $\frac{5}{8}$ W. mag.), passing 40 feet northward of the bushes marking the mud bank. From the wharf at Bowers, the best water generally favors the ebb-tide bends to the head. The river has been straightened by cuts across the sharper bends, the old bed of the stream having been filled by the dredged material near the cuts.

Bowers is a post village and summer resort on the point of land between Murderkill and St. Jones Rivers, and is prominent from off-shore. Gasoline and provisions are obtainable.

Tides.—The mean rise and fall of tides is 5.4 feet at the entrance and 2.7 feet at Frederica.

St. Jones River is 23 miles northwestward of Cape Henlopen lighthouse and $\frac{1}{2}$ mile northward of the entrance to Murderkill River. Improvements are authorized to dredge a channel 7 feet deep to the city of **Dover**, 15 miles above the mouth, to have a width of 100 feet in the entrance and 40 to 50 feet above. In 1923 there was a depth of about $3\frac{1}{2}$ feet at the entrance and 4 feet to **Lebanon**, a village about $9\frac{1}{2}$ miles above the mouth. No work has been done above Lebanon; in 1923 it was good for a depth of about 3 feet to Dover and was little used above Lebanon. The deepest draft entering the river is about 8 feet.

A drawbridge with a clear width of 31 feet crosses the river at **Barker Landing**, 6 miles above the mouth, and 1 mile westward of the bridge is the village of **Magnolia**. A drawbridge crosses the river at Lebanon; width of opening 37 feet. Dover has railroad communication, and Lebanon and the landings below have communication with Philadelphia by a passenger steamer.

There is a lighted range for entering St. Jones River, each a white post, which shows about 100 yards to the right of a white house on the wharf at Bowers Landing. A mud bank on the south side of the entrance is bare at the inner end at half tide and at the outer end at extreme low water, and is usually marked by bush stakes.

To enter St. Jones River, from the can buoy off the entrance head in on the range, course 266° true (W. $\frac{1}{4}$ N. mag.), passing 40 feet northward of the bushes marking the mud bank. From Bowers Landing, just inside the mouth, the best water favors the southwest side for about $\frac{1}{2}$ mile, and then a general mid-channel course in the straight reaches and the ebb-tide bends in the curves is the best to the head.

Tides.—The mean range of tides is 5.4 feet at the entrance, 2.5 feet at Lebanon, and 1 foot at Dover.

Little Creek, $11\frac{1}{2}$ miles southward of Mahon River lighthouse, is navigable to the village of Little Creek, $2\frac{1}{2}$ miles above the mouth. A channel has been dredged to a depth of 5 feet to Little Creek, 60 feet wide across the bar and 40 feet wide in the creek. The controlling depth in 1923 was $2\frac{1}{2}$ feet to Little Creek Landing. There is a lighted range for entering, course 310° true (NW. $\frac{1}{4}$ N. mag.), plainly visible by day. The best water follows the northeast side around the bend from the north point at the entrance until past the front light, and then the mid-channel to the head. The mean rise and fall of tides is 5 feet at the entrance and 4.5 feet at Little Creek. High and low water at Little Creek occur 30 minutes and 50 minutes, respectively, later than at the entrance. Small boats can go a short distance above a drawbridge at Little Creek.

Mahon River is marked by Mahon River lighthouse (a light on white house) and three smaller houses around it. There is a depth of about 5 feet across the bar at the mouth and 10 to 15 feet inside, and it is extensively used as an anchorage by oyster and fishing boats. The point of marsh on the east side at the entrance is wearing away, and a shoal extends southward from it. The base of an

old lighthouse, which is covered at high water, lies close inshore, $\frac{3}{8}$ mile southward of the entrance. The southerly edge of the east red sector of Mahon River lighthouse marks the entrance at night. Small boats can pass through Mahon River into Dona River, but there is little business above the mouth.

Dona River, $2\frac{1}{4}$ miles northward of Mahon River lighthouse, has a depth of about 3 or 4 feet across the flats at the mouth and 6 to 12 feet inside. It is used to some extent as an anchorage. The entrance is not marked. Small boats can, with difficulty, pass through into Leipsic River, but it is not often done.

Leipsic River, $3\frac{1}{2}$ miles northward of Mahon River lighthouse and $3\frac{3}{4}$ miles south-southwestward of Ship John Shoal lighthouse, is the approach to the town of Leipsic, about $8\frac{1}{2}$ miles above the mouth. A channel 6 feet deep and 50 feet wide, with several cut-offs, has been dredged to Leipsic, and 5 feet deep and 40 feet wide to the head of navigation about $4\frac{1}{2}$ miles above Leipsic, with a turning basin at the head. The controlling depth in 1923 was 4.8 feet to Leipsic and $2\frac{1}{2}$ feet to Garrison Mill. A drawbridge with a draw opening 35 feet wide crosses the river at Leipsic. The south opening has the best water.

There is a lighted range for entering Leipsic River, each a post with slatted daymark, plainly visible by day. The course on the range is 285° true (WNW. mag.), and it should be closely followed to avoid shoals close to it on the south side. Above the entrance a general mid-channel course is the best.

Tides.—The mean rise and fall of tides is 5.9 feet at the entrance, 3 feet at Leipsic, and 2.5 feet at the head of navigation.

Duck Creek, extending from Leipsic River to Smyrna River, is navigable at high water throughout most of its length from Leipsic River, but has a dam at the northern end which prevents entrance from Smyrna River. It is used only by boats with hunting parties and schooners carrying marsh hay. A fixed bridge crosses the creek just back of Woodland Beach.

Smyrna River, $5\frac{3}{4}$ miles southward of Stony Point Shoal, is navigable to Smyrna Landing, about 9 miles above the mouth and 1 mile from the town of Smyrna. The deepest draft entering is about $7\frac{1}{2}$ feet, and this draft is taken to the head at high water. Improvements are authorized to construct jetties at the entrance and obtain a channel 7 feet deep to Smyrna Landing, 100 feet wide across the bar at the entrance and 60 feet wide inside, and there are to be several cut-offs across the sharper bends; in 1923 there was a depth of 4 feet to Smyrna Landing. There is a lighted range for entering, front light on a white post and rear light on a skeleton structure (white on range face, remainder black), both plainly visible by day. A white dwelling shows 250 yards to the left of the range.

There is a spoil bank, bare at low water, on the south side of the entrance of Smyrna River. The range leads across a shoal bar about $\frac{1}{2}$ mile outside the entrance. Local steamers usually enter at near high water, when the bar can be crossed on the range, but if entering at low water, must pass well southward of it and then steer northwestward inside the bar until on the range, but some local knowledge is required to carry the best water. From inside the entrance to the head the best water generally follows a mid-channel course or favors the ebb-tide bends. A drawbridge crosses the river

at Flemings Landing, 3 miles above the mouth. It is a center-pier draw, each opening 38 feet wide; the north opening is generally used.

Tides.—The mean rise and fall of tides is 6 feet at the entrance and 3.5 feet at Smyrna Landing. High and low water at Smyrna Landing occur 2 hours and 13 minutes later than at the entrance.

DELAWARE BAY, EASTERN SIDE.

The eastern side of Delaware Bay is low and has few prominent marks except the lighthouses. There are many small creeks, frequented mostly by fishing and oyster boats and a few truck boats, and two large tributaries, Maurice and Cohansey Rivers, which have considerable trade, the deepest draft being about 11 feet.

The ruling depth on the eastern side of Delaware Bay is 7 to 15 feet, with many spots of less than 6 feet. These shoals are generally unmarked and some local knowledge is required to avoid them. There are bars at the mouths of the creeks and deeper water inside.

Cape May, on the eastern side of the entrance to Delaware Bay, is marked by the large hotels at the town of Cape May and by Cape May lighthouse at the town of Cape May Point. Storm warnings are displayed at Cape May Point Coast Guard station, southward of the lighthouse.

The shoals and channels on the northeast side of Delaware Bay entrance, southward and westward of Cape May, are subject to change both in depth and position, the general direction of movement being southward. **Cape May Channel** is the principal one of several buoyed channels, and by the latest survey, made in 1914, had a least depth of 15 to 18 feet at its inner end between **North Shoal** and **Crow Shoal**. For the latest information concerning the channels and the positions of the buoys reference is made to the chart. The channels have strong tidal currents. Strangers should enter the bay by the main channel along the southwest side, which is broad and deep.

There are several unimportant creeks northward of Cape May, but the first one open to navigation is **Goshen Creek**, $13\frac{1}{2}$ miles north-northeastward of Cape May lighthouse. There is a depth of about 1 foot across the flats at the mouth and 2 feet to **Goshen Landing**, 1 mile above the mouth and 1 mile below the village of **Goshen**. It is only entered by small local boats.

Dennis Creek, $6\frac{3}{8}$ miles eastward of East Point lighthouse, has a depth of 2 feet across the flats at the mouth and 6 to 12 feet inside. It is navigable for a considerable distance, but is principally used as an anchorage by oyster boats. The entrance is marked by range lights, which lead in the best water across the flat in the approach. There is a fixed highway bridge across the creek near **Dennisville**.

West Creek, 1 mile northwestward of the entrance to Dennis Creek, is nearly bare at low water at the mouth and has a depth of about 3 feet inside. It is little used.

Deadman Shoal, lying $5\frac{3}{8}$ to 7 miles southward of East Point lighthouse, had a least depth of 3 feet in 1914. It is marked on the east side by a gas buoy and at the north end by a horizontally striped buoy. Extending southward (true) from the west end of the shoal is a ridge with 6 to 7 feet over it, the south end of which lies 3 miles southwestward from the gas buoy.

East Point lighthouse, a white dwelling on the point on the east side of Maurice River Cove, is the most prominent mark in the vicinity.

Maurice River is navigable to the city of Millville, 21 miles above the mouth. The landings near the mouth are the center of a large oystering and fishing industry, and there is considerable trade in the upper river, mostly in towed sand barges. The deepest draft entering the river is 11 feet, and this draft is taken to Millville at high water.

The river is under improvement to obtain a channel 100 feet wide and 7 feet deep to Millville. In 1923 there was a depth of $4\frac{1}{2}$ feet and width of 100 feet in a dredged channel across the flats outside the mouth. From inside the mouth to within 4 miles of Millville there is a natural channel with a least depth of about 10 feet, and from there to the mill dam $\frac{1}{2}$ mile above the lower bridge at Millville there is a least depth of 4 feet, most of the way through a dredged channel.

Bivalve is a railroad terminus and important oyster-shipping point on the west bank, of Maurice River, $2\frac{1}{2}$ miles above the mouth. Gasoline and provisions are obtainable and there is water on the wharves. There is a railway capable of hauling out vessels of 150 tons and 6 or 7 feet draft, and a machine shop for ordinary repairs to motors. Storm warnings are displayed.

Maurice River, a post office opposite Bivalve, is also the terminus of a railroad and a shipping point for sea food. Matts Landing is 1 mile above Maurice River.

Port Norris is a town about $\frac{3}{4}$ mile from the river and northward of Bivalve.

Between Port Norris and Millville are the villages of Leesburg, Dorchester, and Port Elizabeth on the east bank, all on the railroad, and Mauricetown on the west bank. There are railways at Dorchester capable of hauling out vessels of about 100 tons and 6 feet draft, and a machine shop for ordinary repairs to motors. A highway drawbridge crosses the river at Mauricetown. It has a center pier draw, width of openings 58 feet. Either opening is clear, but the eastern opening is the one generally used, as there is a westerly set on both ebb and flood tide.

Millville is an important town at the head of navigation on Maurice River. It has railroad communication and several factories. A drawbridge having a draw opening 36 feet wide crosses the river at the lower end of the wharves. Gasoline and provisions may be obtained.

Tides.—The mean rise and fall of the tides is 5.8 feet at the entrance and 4.7 feet at Millville; it is high water at the latter place about $2\frac{3}{4}$ hours later than at the mouth of the river. The tidal currents change at the entrance 1 hour and at Mauricetown $\frac{1}{2}$ hour after high and low waters. At Millville the flood current changes to ebb a little before high water, and the ebb changes to flood about $\frac{3}{4}$ hour after low water; this applies to the river in summer, when there are no freshets.

Directions, Maurice River.—There are numerous oyster stakes off the entrance, but no difficulty will be experienced if guided by the fixed aids until sure of the buoys. The following courses will lead in a depth of 9 feet or more until approaching the entrance:

A 358° true (N. $\frac{1}{2}$ E. mag.) course from a position $\frac{1}{2}$ mile westward of the western end of Cape May Point will lead to a position $\frac{3}{8}$ mile eastward of Deadman Shoal gas buoy. Then a 335° true (N. by W. $\frac{1}{2}$ W. mag.) course, passing $\frac{3}{8}$ mile eastward of Deadman Shoal gas buoy, will lead to a position $\frac{1}{4}$ mile southwestward of the entrance to the dredged channel.

Or a 14° true (NNE. mag.) course with Brandywine Shoal lighthouse astern will lead to the above position off the entrance.

Coming down Delaware Bay the safest course for a stranger is to pass southward of the buoy at the south end of Miah Maull Shoal, steer 82° true (E. mag.) for $4\frac{1}{2}$ miles, until East Point lighthouse bears 35° true (NE. $\frac{1}{4}$ N. mag.), then steer 31° true (NE. $\frac{1}{2}$ N. mag.) for $4\frac{3}{4}$ miles to the entrance of the dredged channel.

The channel across the bar and into Maurice River is marked by buoys and a lighted range, each light on a white post with slatted daymark. There is a dwelling a little to the right of the range. The center line of the dredged channel follows the northern edge of the white sector between two red sectors in East Point lighthouse on a 47° true (NE. $\frac{7}{8}$ E. mag.) course until on the range, then a 346° true (N. $\frac{1}{2}$ W. mag.) course on the range until inside the mouth. On the flood, vessels should guard against a northwesterly set. For a distance of 16 miles above the entrance the channel has ample width and is easily followed; in the absence of local knowledge it is safer to take it on a rising tide and proceed with caution. In the upper 5 miles to Millville the channel is narrow and some local knowledge is required to follow the dredged channels. Towboats bound to or from the upper part of the river usually run with the current.

There is a narrow cut through the marsh leading into Maurice River about $\frac{3}{8}$ mile eastward of the main entrance. It has a depth of about $2\frac{1}{2}$ feet and is much used by motor boats.

Dividing Creek, $2\frac{1}{2}$ miles northeastward of Egg Island lighthouse, has a depth of about $2\frac{1}{2}$ feet across the flats at the mouth and 5 to 15 feet inside. A draft of about 4 feet at high water can be carried through a very narrow crooked channel to the town of Dividing Creek, about 8 miles above the mouth. It is used only by a few oyster boats.

Oranoken Creek, $\frac{1}{2}$ mile westward of Dividing Creek, has a depth of about $2\frac{1}{2}$ feet across the flats at the entrance and deeper water inside. It is little used.

Egg Island lighthouse (occulting white every 2 seconds), a white dwelling, is the most prominent mark in its vicinity. There are shoals southward of the point marked on the south and west sides by buoys; also an unmarked slough, good for a depth of about 7 feet, close along the point inside the shoals. The slough is used by local vessels, but strangers should pass southward of the shoals.

Fortescue Beach is a post village and small summer settlement on the shore about 4 miles north-northwestward of Egg Island Lighthouse.

Nantuxent Creek, $6\frac{1}{4}$ miles east-southeastward of Ship John Shoal Lighthouse, has a depth of about 5 feet in the entrance, and is navigable at high water to within about 1 mile of the village of Newport. It is used only by local oyster boats.

Shoal spots with a least depth of about 5 feet extend about 1 mile south-southwestward of Nantuxent Point, and are marked off the

west side by Hog Shoal gas buoy. Boats bound alongshore should keep outside of the buoy and well eastward of Ben Davis Point Shoal, which has a depth of 5 feet and borders the main channel of Delaware Bay.

Cedar Creek, $1\frac{3}{4}$ miles eastward of Ben Davis Point, has a depth of 4 feet across the flats at the mouth, $4\frac{1}{2}$ feet for a distance of about 3 miles above the mouth, and about $3\frac{1}{2}$ feet at high water for a farther distance of $2\frac{1}{2}$ miles to the village of Cedarville. The mouth is used as an anchorage for small boats and there is little traffic above.

Back Creek, on the east side of Ben Davis Point, has a depth of about 5 feet across the flats at the entrance, and is navigable with a good depth of water for about 3 miles. It is used only as an anchorage by local boats.

Cohansey River, marked by Cohansey Lighthouse (a white dwelling), is navigable to the city of Bridgeton, $17\frac{1}{2}$ miles above the entrance. It has considerable trade, carried mostly in barges to the upper end, and small schooners and motor boats in the lower end. The deepest draft entering the river is about 11 feet, and this draft is taken to Bridgeton at high water. A large amount of garden truck is shipped down the river in season.

A new mouth 100 feet wide and 7 feet deep has been dredged into the river 500 yards northwestward of Cohansey Lighthouse, and the channel has been improved above to secure a width of 100 feet and depth of 7 feet to the lower drawbridge at Bridgeton, and a width of 60 to 75 feet and depth of 7 feet for a farther distance of about $\frac{1}{4}$ mile to the head of navigation. In 1923 the controlling depth to Bridgeton was 4 feet.

Greenwich Pier, a railroad terminus and shipping point for sea food, is on the west bank of Cohansey River, about 4 miles above the entrance. Gasoline, provisions, and water are obtainable. There is a railway capable of hauling out small vessels up to 8 feet draft, and machine shop for ordinary repairs to motors. Greenwich is a town about 1 mile from the wharves.

Fairton is a village on the east bank of Cohansey River, $3\frac{1}{2}$ miles below Bridgeton.

Bridgeton is an important manufacturing town and railroad center at the head of navigation on Cohansey River. There are two drawbridges at Bridgeton, each a center pier draw, both openings clear. The clear width of openings of the lower bridge is 42.5 feet and of the upper bridge about 40 feet.

Supplies.—Gasoline, coal, and provisions may be obtained at Bridgeton.

Tides.—The mean rise and fall of the tides is 6.0 feet at the entrance and 6.5 feet at Bridgeton. It is high water at the latter place about 2 hours later than at the entrance.

Directions, Cohansey River.—Vessels approaching the river from northward usually leave the main channel of Delaware Bay southward of the red buoy at the south end of Arnold Point Shoal, steer east-southeastward with Cohansey lighthouse well on the port bow until off the new entrance, and then head in on the axis of the cut. Or, continue the course to the old entrance, $\frac{3}{4}$ mile eastward of Cohansey lighthouse, which has a depth of about 6 feet. It is used

by some vessels approaching from southward, also by some local vessels approaching from northward at night. A shoal extends east-southeastward and east-northeastward from the lighthouse, and the point should be given a good berth.

From inside the entrance to about 1 mile below Bridgeton there is a natural channel with ample width and depth and easily followed; in the absence of local knowledge it is safer to take it on a rising tide and proceed with caution. Thence to Bridgeton the channel has been obtained by dredging, and some local knowledge is required to follow it. Vessels bound to or from the upper part of the river usually run with the current.

Stow Creek, 3 miles northwestward of Cohansey lighthouse, has a depth of about 4 feet in the entrance and deeper water inside. It is said to be navigable at high water to within about 1 mile of the village of **Canton**, about 10 miles above the entrance. There are farm landings near the head from which some produce is shipped, the deepest draft being 6 feet. The best water in entering lies close along shore southward of the entrance, then eastward and northward of the island in the mouth.

Bayside, at the mouth of Stow Creek, is a railroad terminus and important shipping point for sea food. There is a depth of 3 feet at the wharf. Gasoline and some provisions are obtainable during the fishing season.

Mad Horse Creek, 6 miles northwestward of Cohansey lighthouse, has a depth of about 5 feet in the entrance. It is navigable for several miles but is entered only by an occasional truck boat.

DELAWARE RIVER BELOW CHRISTIANA RIVER.

Hope Creek, on the east side, $1\frac{3}{4}$ miles southeastward of Stony Point Shoal, has a depth of about 2 feet at the mouth and is navigable for several miles, but is little used.

Blackbird Creek, on the west side, $\frac{3}{8}$ mile southward of Reedy Island range front light, can be entered with a draft of about 3 feet at low water by following the shore from well southward of the entrance, as mentioned in the description of Appoquinimink Creek, and this draft can be carried several miles above the mouth. It is frequented only by small produce boats. The creek is crossed by a drawbridge about 4 miles above the mouth, but it is seldom opened.

Appoquinimink Creek, marked at the mouth by range lights (posts with slatted daymarks), is navigable at high water for vessels of 8 feet draft to the village of **Odessa**, 6 miles above the mouth, and for small boats a farther distance of about 2 miles.

The channel in Appoquinimink Creek has been improved by dredging and by cut-offs across the bends. In 1922 there was a depth of 5 feet from inside the bar at the mouth to Odessa; no work has been done outside the mouth. There is a least depth of about 2 feet on the axis of the range between the mouth and deep water in Delaware River.

A depth of about 3 feet at low water can be taken into the entrance of Appoquinimink Creek by running close inshore from abreast **Rays Ditch**, about $1\frac{1}{2}$ miles below the entrance. The best water leads close to the end of a jetty, submerged at high water and unmarked, lying about 1 mile below the entrance; from here pass about 150

yards off the marsh on the north side of Blackbird Creek and 350 yards off the marsh on the south side of Appoquinimink Creek until on the range. From inside the month to Odessa the best water follows a general mid-channel course.

A drawbridge crosses Appoquinimink Creek about 3 miles above the mouth. The bridge is a center-pier draw, each opening 39 feet wide, with a headroom of 5 feet at high water. There is a drawbridge just above the wharves at Odessa with a single clear opening 44 feet wide and a headroom of $4\frac{1}{2}$ feet at high water.

Tides.—The mean rise and fall of the tides is 5.2 feet at the mouth and 3.3 feet at Odessa. At Odessa high and low water occur about one hour after high and low water at the mouth.

The shoalest part of **Stony Point Shoal** has been surrounded by a bulkhead and raised to above high water by dumping, forming an artificial island about $2\frac{1}{2}$ miles long. A dike, visible at all stages of the tide, connects the south end with **Stony Point**. The area back of this island has shoaled to a general depth of about 5 feet.

Alloway Creek, eastward of the north end of the artificial island on **Stony Point Shoal**, is navigable for vessels to the village of **Quinton**, 7 miles above the mouth, and with some difficulty for small boats at high water for a farther distance of 4 miles to the village of **Alloway**. A channel 6 feet deep and 60 to 75 feet wide has been dredged to **Quinton**. The controlling depth in 1922 was 5 feet. Two cut-offs have been made across sharp bends, one $1\frac{1}{4}$ miles above the entrance and the other above **Hancocks Bridge**; also two short dikes have been constructed $2\frac{1}{2}$ and $5\frac{1}{2}$ miles above the entrance.

A drawbridge crosses the creek at the post village of **Hancocks Bridge**, 4 miles above the mouth. The bridge has a center pier draw, each opening about 40 feet wide, with the best water in the north opening.

Upper Hancocks Bridge crosses the river $5\frac{1}{2}$ miles above the entrance; width of opening, 42 feet. There is a drawbridge at **Quinton**, width of opening 35 feet.

Boats entering **Alloway Creek** must pass northward of the artificial island on **Stony Point Shoal**, and should enter the creek on a northeasterly course to avoid shoals off the points on either side. Above the entrance the best water does not always follow midstream, and some local knowledge is required to keep in the best water. Strangers should take it on a rising tide and proceed with caution.

Tides.—The mean rise and fall of tides is 6 feet at the entrance, 4 feet at **Quinton**, and 2.5 feet at **Alloway**.

Reedy Island is the site of a national quarantine station, and storm warnings are displayed. A dike extends $2\frac{1}{2}$ miles southward from the south end of the island. It is covered by the red sector of **Old Reedy Island lighthouse**. The lower end is submerged at high water. There is no navigation around the south end of the jetty except in small motor boats. **Old Reedy Island lighthouse**, a white tower on a dwelling, is on the dike $\frac{1}{4}$ mile southward of **Reedy Island**. About midway between the lighthouse and the south end of **Reedy Island** is an opening in the dike 150 feet wide, with a depth of 5 feet at low water, used by boats up to 7 feet draft bound to **Port Penn**. The opening is not marked, but the dike on each side is visible at high water.

Port Penn is a village on the west bank westward of **Reedy Island**. It can be approached from southward, through the opening in the dike at the south end of **Reedy Island**, and from northward with a depth of about 7 feet by passing westward of **Reedy Island Bar**. The anchorage off the town, known as **Reedy Island Harbor**, has a depth of about 20 feet, but is little used except during the fishing season. There are depths of 1 to 2½ feet at the wharves at **Port Penn**, and 10 feet at the pier, about ½ mile southward of the town.

Salem River, emptying into **Salem Cove**, 3 miles southeastward of **Pea Patch Island**, is the approach to the city of **Salem**, at the junction of **Salem** and **Little Salem Rivers**, 3 miles above the mouth. There is considerable trade to **Salem** in steamers, barges, and many smaller boats. The deepest draft entering is about 10 feet. Improvements are in progress to obtain a channel 9 feet deep and 100 feet wide from **Delaware River** to a fixed bridge crossing **Little Salem River** a little over ½ mile above its junction with **Salem River**. In 1923 a draft of 7 feet at low water could be carried across **Salem Cove** into the river and 2,000 feet beyond **Penns Neck Bridge** and thence 4½ feet to the fixed highway bridge at **Salem**.

The channel across **Salem Cove** follows the southeast side and is marked by buoys and by a set of range lights. The front range is a post on a white house with black base, and the back range is a tall white mast above a house.

To enter **Salem River**, pass southward of the gas and bell buoy at the intersection of the **New Castle** and **Reedy Island** ranges, and steer eastward for ¼ mile, passing southward of entrance buoy No. 1, and head up on the range. Then steer 28° true (NE. 7/8 N. mag.) on the range for about 11/8 miles to buoy No. 4, haul eastward, passing 150 yards off the point on the south side, and be guided by the buoys in the river. The best water then favors the north side until around the first bend and about ¾ mile above the north point at the entrance, and then follows a general mid-river course to the lower wharves at **Salem**. There is a drawbridge crossing **Salem River** just below the mouth of **Little Salem River**. It is a center pier draw, south opening 49.5 feet wide and north opening 46.5 feet wide and having 6.5 feet headroom above high water; both openings are used.

Supplies.—Coal in limited quantities and gasoline can be obtained at **Salem**, and there is water on the wharves.

The mean rise and fall of tides is 5.9 feet at the entrance and 6.4 feet at **Salem**.

Salem River was originally navigable to **Courses Landing**, 15 miles above **Salem** and 2½ miles below the village of **Sharptown**. A dam has been placed across the river about 9 miles above **Salem**, and the river above the dam is connected with **Delaware River** by **Salem Canal**.

Salem Canal and **Salem River** above the dam are said to be navigable, with a draft of 4 or 5 feet at high water to **Courses Landing**. They are used only by a few truck boats. The entrance to **Salem Canal** is marked on the north side by **Deepwater Point range front light** (black and white tower with slatted daymark).

Pea Patch Island is low, and shoals extend for a long distance northward and southward of it.

Delaware City is on the west bank of **Delaware River**, southwestward of **Pea Patch Island**. The eastern entrance to the **Chesapeake**

& Delaware Canal is located here. The city has little trade except that passing through the canal. There is a depth of about 12 feet at the wharves, and provisions, water, and coal in limited quantities can be obtained. A description of the Chesapeake & Delaware Canal is included with "Inside route, New York to Norfolk," on page 229.

Bulkhead Shoal Channel, westward of Pea Patch Island and Bulkhead Shoal, is used only by boats of 9 feet or less draft, bound through the canal. A curved jetty extends $\frac{5}{8}$ mile westward from the eastern band of Delaware River, 2 miles above Pea Patch Island, and is marked at its end by a light. A pile of rocks with 4 feet over them, lying $\frac{3}{8}$ miles southwestward of the light, is marked off its west side by gas buoy No. 2D.

New Castle is a town on the west bank of Delaware River, 4 miles below the entrance of Christiana River. It has little trade. The main wharf has a depth of 4 feet at its end, and the other wharves are in bad repair. There is a foundry $\frac{3}{4}$ mile northward of the town, with a wharf in front of it having a depth of 12 feet at the end. A small harbor, protected from drifting ice by ice breakers, is located at New Castle.

Pennsville is a village on the east bank, $3\frac{1}{2}$ miles below the entrance to Christiana River. There are depths of 7 to 8 feet at the wharves.

There is a railroad wharf, with a depth of 9 feet at the end, on the end of **Pigeon Point**, 1 mile southward of the entrance to Christiana River. It is used as a shipping point for coal and other freight, principally in car floats and barges. Coal and water are obtainable. There is a railroad wharf and car ferry slip at Deepwater Point, which is the site of large factories. There is 26 feet off the wharf.

CHRISTIANA RIVER,

on the west side of Delaware River about 64 miles above Cape Henlopen and 26 miles below Philadelphia, is the approach to the city of Wilmington, $2\frac{1}{2}$ miles above the mouth, and the villages of Newport and Christiana.

Wilmington has large manufacturing interests and considerable trade by water. The deepest draft entering is about 20 feet, and the usual draft about 10 feet. The city is connected with Chester and Philadelphia by passenger and freight steamers and with Penns Grove by ferry.

Channel.—Improvements are in progress to obtain a channel 21 feet deep for a distance of $3\frac{1}{2}$ miles above the entrance to within 300 yards of the first bridge above Mill Creek, 10 feet deep to the bridge and 7 feet deep for a farther distance of $4\frac{1}{4}$ miles to the village of **Newport**. The project width is 250 feet from the entrance to the mouth of Brandywine Creek, 200 feet to the upper limit of the 10-foot project, and 100 feet to Newport. The project has been completed, but the channel is subject to considerable shoaling. In 1923 there was a depth of about 16.5 feet to the Harlan plant, 14 feet to the pulp works, and a depth of $4\frac{1}{2}$ feet to Newport.

Two parallel jetties have been constructed at the entrance. The north jetty is visible at all stages of the tide and has a light (post on white house) and fog bell on the end. The **Bellevue range rear light**

(black skeleton tower) is near the inner end of the jetty, and is prominent. The south jetty is submerged at extreme high water, and is marked at the outer end by a white skeleton tower on a house. There is an authorized project under way which provides for a harbor at the mouth of the river with an entrance channel 25 feet deep and 400 feet wide, and an inner basin of the same depth extending upstream to Lobdell Canal.

Christiana is a village at the head of navigation on Christiana River, about 12 miles above the entrance. A draft of 2 feet at low water and about 5 feet at high water can be taken to the town. There is some trade in motor boats and barges up to 4 feet draft.

Brandywine Creek, emptying into Christiana River $1\frac{1}{4}$ miles above the entrance, is good for a depth of about 4 feet at low water to the railroad bridge 1 mile above the mouth, and a draft of about 6 feet at high water can be taken a farther distance of about $\frac{3}{4}$ mile to a fixed bridge at the head of navigation. There is considerable traffic, mostly in barges of 4 to 6 feet draft. The channel is rocky above the railroad bridge.

Bridges.—The following are the drawbridges crossing Christiana River, the distance in nautical miles above the outer ends of the jetties at the entrance, the least width of the two draw openings, and the clear height above high water:

Pennsylvania Railroad (lower), 1.2 miles, 90 feet, 7.3 feet.
River front (highway), 2 miles, 145 feet.
Market Street (highway), 2.7 miles, 97 feet, 5.7 feet.
Baltimore & Ohio Railroad, 3.1 miles, 70 feet, 6 feet.
Pennsylvania Railroad (middle), 3.6 miles, 70 feet (east), 62 feet (west), 7 feet.
Philadelphia & Reading Railroad, 3.7 miles, 66.5 feet (east), 57.3 feet (west), 4 feet.
Pennsylvania Railroad (upper), 4.8 miles, 40 feet, 4 feet.
Newport (highway), 8 miles, 30 feet (south), 6.1 feet.
Churchmans (highway), 10.3 miles, 27 feet, 5 feet.

Four bridges cross Brandywine Creek between the mouth and the head of navigation, and all have draw openings.

Bridge regulations prescribed for the highway bridges crossing Christiana River and Brandywine Creek require that the draws shall be opened immediately at all times of the day or night upon a signal of three blasts of a whistle or horn if no person or vehicle passing over the bridge is then in the way. The answer from the bridge is three blasts of a whistle or horn if the bridge can be opened immediately, and two blasts if the bridge can not be opened immediately.

Regulations prescribed for the railroad bridges crossing Christiana River and Brandywine Creek require that the draws shall be opened immediately at all times of the day or night upon a signal of three blasts of a whistle or horn, unless a train is due to arrive within 5 minutes of the time of giving the signal. But in no case shall there be a delay of more than 10 minutes in opening the draws. The signal shall be answered from the bridge by three blasts of a whistle or horn if the bridge can be opened immediately, and two blasts if the bridge can not be opened immediately.

Channel regulations.—(1) Vessels over 20 tons propelled by machinery shall not proceed at any time within the limits of these waters at a greater speed than 8 statute miles per hour. (2) Vessels over 15 tons propelled by machinery passing any plant employed in the

improvement of said waters shall not proceed at a speed greater than 4 statute miles per hour, and the propelling machinery of vessels passing any such plant shall be stopped at a distance of 300 feet from said plant and not started in motion until said vessel shall have passed abreast of such plant, except where it may become necessary to avoid an accident, or in the case of a vessel with heavy tow. When it becomes necessary for a vessel to pass between any such plant and any buoys indicating the position of the mooring anchors of such plant, such vessel shall give the following warning signal to said plant to lower the mooring lines: Four short blasts of a whistle or horn in quick succession, said warning signal to be given when said vessel is about $\frac{1}{2}$ mile away from the plant.

Paragraphs 3 to 9 of the regulations for Delaware River, given on page 41, apply to Christiana River.

Supplies.—Water, provisions, ship chandlery, and coal in any amount can be obtained at Wilmington.

Repairs.—There are good facilities for the construction and repair of hulls and machinery. There are a dry dock and several marine railways, the dry dock having a length on blocks of 343 feet, depth on sill of 13 feet, and a capacity of 4,000 tons, and the largest railway having a length on blocks of 180 feet, a depth of 8 feet forward and 12 feet aft, and a capacity of 900 tons.

Tides.—The mean range of tides is 5.8 feet at Wilmington, 5.6 feet at Newport, and 3.5 feet at Christiana. High and low water at Newport occur 1 hour 10 minutes and 1 hour 40 minutes, respectively, later than at Wilmington, and at Christiana 2 hours 30 minutes and 3 hours, respectively, later than at Wilmington.

DIRECTIONS, CHRISTIANA RIVER.

The following directions are available for small vessels of 10 feet or less draft; vessels of deeper draft should take a pilot: Enter the river on a course about 335° true (N. by W. $\frac{1}{2}$ W. mag.), heading 40 yards to the right of Bellevue range rear lighthouse and 50 yards to the left of the light on the end of the north jetty. Pass close to the end of the north jetty and follow it at a distance of 100 to 200 feet to its inner end. Then steer 267° true (W. $\frac{1}{2}$ N. mag.) for 500 yards, and then favor slightly the southwest bank at a distance of about 100 yards to the first bridge. From this point to 200 yards above the third bridge the mid-channel is the best water, and from there to the first bridge above Mill Creek the channel leads along the north and west sides. From that point to Newport the best water is about in mid-river.

DELAWARE RIVER, CHRISTIANA RIVER TO PHILADELPHIA.

There is a powder factory on Carney Point, on the south side of Helms Cove, eastward of the entrance to Christiana River. A tank and several chimneys are prominent.

Pennsgrove is a town on the east side of Delaware River, 2 miles northeastward of the entrance to Christiana River. It is a railroad terminus, and has communication by ferry with Wilmington. There is a depth of 7 feet at the steamboat wharf.

Edgemoor is a village on the west side of Delaware River, 2 miles northward of the entrance to Christiana River. A rolling mill and a buoy depot of the Lighthouse Service are located here.

A dike, marked at its end by a red buoy, extends 580 yards off **Oldmans Point**, on the east bank, between **Marcus Hook Bar** and **Cherry Island Flats**. The outer end is submerged. Southward of the dike there is an Army pier.

Oldmans Creek, on the east side of Delaware River, 4 miles above Christiana River, is the approach to the villages of **Pedricktown** and **Auburn**, $4\frac{1}{2}$ and $9\frac{1}{2}$ miles, respectively, above the mouth. Considerable produce is shipped from the creek, the deepest draft of vessels being 8 feet. A channel 6 feet deep and 100 feet wide has been dredged across the bar at the mouth, 6 feet deep and 75 feet wide to Pedricktown, and 5 feet deep and 40 feet wide to Auburn, and nine cut-offs have been made between the mouth and Auburn. The controlling depth to Pedricktown is 4 feet and 3 feet to Auburn, with a variable width of channel.

To enter **Oldmans Creek** steer about 73° true (E. $\frac{3}{4}$ N. mag.) with **Cherry Island range rear light** (black circular day mark on mast above white tower) astern to buoy No. 3, then steer northeastward into the mouth of the creek to buoy No. 5. Above the entrance the best water follows a general mid-creek course to the head.

Three drawbridges cross **Oldmans Creek** below Auburn. The highway bridge $2\frac{1}{2}$ miles above the entrance has a draw opening 34 feet wide, the railroad bridge $\frac{3}{4}$ mile above has a draw opening 32 feet wide, and the highway bridge at **Pedricktown** has a draw opening 30 feet wide. There is a fixed bridge at Auburn under which small boats can pass.

Tides.—The mean rise and fall of tides is 6 feet at the entrance, 2.5 feet at **Pedricktown**, and 1 foot at Auburn. At **Pedricktown** high and low water occur 35 minutes and 25 minutes, respectively, after high and low water at the entrance, and Auburn high and low water occur 2 hours and 45 minutes after high and low water at the entrance.

Marcus Hook, on the west side of Delaware River, 2 miles below Chester, has oil refineries and is an important oil-shipping point. There is a depth of 25 feet at the public wharf and 20 to 30 feet at the oil wharves. Rocky patches with a least depth of 24 feet have been found off the lower oil wharf. The State quarantine station is located here (see p. 43), and also a small harbor, protected from drifting ice by ice breakers.

Raccoon Creek, on the southeast side of Delaware River, 1 mile southward of the lower end of Chester, is the approach to the towns of **Bridgeport** and **Swedesboro**, $11\frac{1}{2}$ and 8 miles, respectively, above the entrance. It has considerable trade in vessels up to $6\frac{1}{2}$ feet draft, and this draft is taken to Swedesboro. A channel has been dredged, and in 1923 had a controlling depth of 7 feet from the entrance to Bridgeport, $5\frac{1}{2}$ feet to Springer Wharf, $2\frac{1}{2}$ miles above Bridgeport, and $4\frac{1}{2}$ feet to Swedesboro.

There is a bar off the entrance with a least depth of 2 feet on it, and a channel eastward of it to the mouth of the creek, with a least depth of 7 feet from southward. A jetty has been built out from the south point and parallels the lighted range line. Do not cross the shoal on this range, but enter the creek around the southwest end

of the bar and through the buoyed channel eastward of it. An unmarked channel of lesser depth enters from the northward, following close to the shore north of the mouth of the creek.

Two bridges, each having a draw opening 32 feet wide, cross Raccoon Creek at Bridgeport. Three bridges cross the creek at Swedesboro. The lower bridge has an opening 60 feet wide; the second is fixed and has a headroom of 21 feet at high water; the third, at the head of the dredged channel, is fixed and has a headroom of 7 feet at high water.

Tides.—The mean rise and fall of tides is 6 feet at the entrance and 5 feet at Swedesboro. At Swedesboro high and low water occur 1 hour and 30 minutes after high and low water at the entrance.

A rocky area having a depth of about 27 feet lies near the intersection of the Marcus Hook and Chester ranges, and between the new 35-foot channel marked by these ranges and the old Schooner Ledge dredged channel. It is marked by a horizontally striped gas buoy. Deep-draft vessels should keep over on the eastern side of the channel when passing gas buoy 2C.

Chester is an important manufacturing city 73½ miles above the entrance to Delaware Bay and 14½ miles below Philadelphia. It has considerable trade in vessels up to 25 feet draft. There is a depth of 22 feet at the long factory wharf ½ mile southwestward of Ridley Creek, 5 to 12 feet at the public wharves between there and Chester Creek, and 8 to 25 feet at the principal wharves of the industrial plants southwestward. Water and limited quantities of coal can be obtained at Chester. There are several machine shops and shipbuilding plants at Chester and marine railways at Essington, 3 miles eastward.

Chester Island, in mid river off the upper wharves at Chester, is marshy and has no prominent mark. A dike visible at high water extends from the upper end of the island to the eastern shore of the river. The channel from the dike to the southwest end of the island has been used as a dumping ground and shoaled to a depth of 4 feet.

Chester Creek has a depth of 5½ feet for a distance of 300 yards above the mouth to the second bridge, and about 3 feet for 2 miles to the village of Upland. There is a railroad drawbridge just inside the mouth, with a single draw opening 52 feet wide and a headroom of 1½ feet at high water, and there are numerous fixed bridges between this point and Upland, having a least headroom of 6 feet at high water. Most of the business in the creek is in barges of about 6 feet draft carrying coal to industrial plants. The mean rise and fall of tides is 5.8 feet at the entrance and about 5 feet at Upland.

Ridley Creek has a depth of about 5 feet at high water to a dam 2 miles above the mouth. The shoalest places are at the mouth and at the head of navigation. The creek is crossed by numerous fixed bridges having a least headroom of 8 feet at high water. There is little business by water.

Eddystone, a town just above Chester, has a large factory and other industrial works.

Crum Creek, just westward of Chester range rear light, is bare in places at low water, and has a depth of 5 feet at high water to the fixed railroad bridge about 1 mile above the entrance. It is crossed

by two drawbridges $\frac{1}{2}$ mile above the entrance, having a least width of 28 feet and a least headroom of 4 feet at high water.

Darby Creek, $\frac{3}{8}$ mile eastward of Chester range rear light, has a depth of about 7 feet for 4 miles above the mouth and 3 feet for a further distance of about 2 miles to the fork, $\frac{1}{2}$ mile from the town of **Darby**. It is used only by small pleasure boats. Three bridges cross the river below the fork. Two of them have draw openings and the third is fixed, but has a high arched span with sufficient headroom for any of the boats using the creek. The mean rise and fall of tides is about 6 feet at the mouth, 5 feet at the fork, and nothing at **Darby**.

Essington is a town on the north side of Delaware River northward of Tinicum Island. There is a depth of 14 feet at the shipyard wharf and 3 to 4 feet at the clubhouse wharves. Vessels bound to the town, unless of light draft, must pass around the western end of Tinicum Island. The largest marine railway has a capacity of 100 tons, and can take out vessels 120 feet long, draft 6 feet forward and 14 feet aft.

Tinicum Island, 11 miles below Philadelphia, is a long, marshy island with bushes on its western end. An oil-pipe line is laid between **Bramell Point** and the east end of Tinicum Island.

There are several large factory buildings between **Thomson** and **Crab Points**, and two wharves, the upper one having a depth of 20 feet at the end and the lower one 11 feet. A large oil depot is located east of **Bramell Point**, and 30 feet can be carried alongside.

Billingsport is a village on the southeast side of Delaware River, 1 mile above the upper end of Tinicum Island. It has communication by steamer with Philadelphia and other points on the Delaware River. There is a depth of 6 feet at the main wharf.

Mantua Creek, on the southeast side of Delaware River, $\frac{1}{2}$ mile above Billingsport, is the approach to the villages of **Paulsboro**, **Mount Royal**, and **Mantua**, $1\frac{1}{2}$, 4, and $7\frac{1}{2}$ miles, respectively, above the entrance. A channel has been dredged 12 feet deep and 100 feet wide from the Delaware River to the fertilizer factory 700 yards above the entrance, 8 feet deep and 80 feet wide to Paulsboro, and 7 feet deep and 60 feet wide to the wharf near Mount Royal. There is a depth of about 1 foot to the head of navigation at Mantua. There are jetties on both sides at the entrance, and the channel is buoyed to the fertilizer factory. The controlling depth in 1923 was 12 feet to the fertilizer factory, 6 feet to Paulsboro, 5 feet to Mount Royal, and 1 foot to Mantua.

A railroad and a highway drawbridge, having clear openings 44 feet and 41 feet wide, respectively, cross the creek at Paulsboro. There are two fixed bridges about $\frac{3}{4}$ mile above the wharf at Mount Royal. The clear width and height above high water of the lower bridge are 70 feet and 10 feet, and of the upper bridge 26 feet and 9 feet. There are two fixed bridges close together at Mantua, with a least headroom of 13 feet at high water, but boats seldom go above them.

Tides.—The mean rise and fall of tides is 5.6 feet at the entrance, 4.5 feet at Paulsboro, 4 feet at Mount Royal, and 2.5 feet at Mantua. High and low water occur later than at the entrance, as follows: Paulsboro, 20 minutes; Mount Royal, 50 minutes; Mantua, 2 hours and 5 minutes.

Woodbury Creek, on the southeast side of Delaware River, 1 mile southward of the entrance to Schuylkill River, has been improved by dredging a channel 6 feet deep and 60 feet wide from Delaware River to a highway bridge 1 mile above the entrance, and 6 feet deep and 40 feet wide to the town of **Woodbury**, $3\frac{1}{2}$ miles above the mouth, with two cut-offs near the mouth and one near the head. The controlling depth in 1923 was 6 feet in the cut outside the mouth and 5 feet to Woodbury. Two drawbridges cross the creek below the head. The lower bridge is a center pier draw with one clear opening 40 feet wide and a headroom of 6 feet at high water when closed; the south opening is the better. The second bridge, $\frac{3}{4}$ mile above the lower one, is a center pier draw with one clear opening 32 feet wide and a headroom of 5 feet at high water when closed. There is a fixed highway bridge at Woodbury with a headroom of 10 feet at high water. The dredged channel stops at this bridge and there is little navigation above. The mean rise and fall of tides is 5.5 feet at the entrance and 4 feet at Woodbury. High and low water at Woodbury occur 40 minutes and 50 minutes, respectively, later than at the mouth.

There is a middle ground in Delaware River northwestward of the entrance to Woodbury Creek, which is marked on the southwest end by **Block Island** light. Vessels bound into Woodbury Creek can pass on either side of the middle ground. The channel at the entrance is buoyed, but some local knowledge is necessary to enter with the best water.

Vessels approaching Woodbury Creek from southwestward should pass 400 yards southwestward and southward of Block Island. Approaching from northward, eastward of the middle ground, pass 100 to 200 yards off the wharf at Philadelphia Sanitarium, 250 yards offshore abreast the white monument at **Red Bank**, and 600 yards off the mouth of the creek. The course in the channel into the entrance is 112° true (SE. by E. $\frac{1}{4}$ E. mag.), passing northward of the buoys and heading for a shanty and landing on the northeast side at the entrance until about 100 yards from it, and then keeping in mid-creek. At low water the channel is well defined in the creek.

Schuylkill River, emptying into Delaware River at the lower end of the city of Philadelphia and at the western end of League Island, is navigable to the entrance of the Schuylkill Navigation Canal, near the **Fairmount Dam**, $7\frac{1}{2}$ miles above the entrance, and by canal for a farther distance of 80 miles. It is an important outlet for a part of the commerce of Philadelphia. There are large storage elevators at Girard Point, oil-refinery wharves opposite **Point Breeze** and at **Gibsons Point**, and other industrial wharves, besides several yacht clubs. The river has a large trade in vessels up to 30 feet draft to Girard Point, 29 feet to Point Breeze, 20 feet to Walnut Street Bridge, and in tugboats and barges to Fairmount Dam.

Dredging is being done by the city of Philadelphia to maintain a channel with a depth of 30 feet to Point Breeze, 26 feet to Gibsons Point, and 21 feet to Harrisons Wharf. Shoaling is liable to occur, but the project depths are maintained as nearly as possible.

Bridges.—The following are the drawbridges crossing Schuylkill River, the distance in nautical miles above the entrance, the least

width of the two draw openings, and the clear height above high water:

Penrose Ferry (highway), 1.2 miles, 183 feet, 18 feet.
Passyunk Avenue (highway), 3.1 miles, 200 feet, 33 feet.
Baltimore & Ohio Railroad, 4.6 miles, 75 feet, 18.5 feet.
Greys Ferry (railroad), 4.9 miles, 75 feet, 22.8 feet.
Greys Ferry (highway), 4.9 miles, 75 feet, 22 feet.
Pennsylvania Railroad, 5.7 miles, 65 feet, 25.5 feet.
South Street (highway), 6 miles, 100 feet (basculer lift).

Walnut Street Bridge, 6.5 miles above the entrance, and the bridges above as far as Fairmount Dam, are fixed and have sufficient headroom for the passage of small tugboats and barges. The least headroom at high water is 21 feet.

Bridge regulations prescribed for the drawbridges crossing the Schuylkill River require that they shall be opened at all times during the day or night to all vessels that can not pass underneath them, if no person or vehicle passing over the bridge is then in the way or a railroad train is on the bridge or within 5 minutes of the schedule time of a passenger train. The signal is three blasts of a whistle or horn, to be answered from the bridge by three blasts if the bridge can be opened immediately, or two blasts if the bridge can not be opened immediately. The draw need not be opened for the passage of a tug or other craft equipped with a smokestack which can be lowered so as to permit passage under the closed draw.

The channel in Schuylkill River is narrow and crooked, and is marked by range beacons from the entrance to **Yankee Point**, numbered consecutively from the mouth. **Schuylkill River range lights** (triangular slatted day marks), although not numbered, are considered to be range No. 1, and range No. 5, leading through Penrose Ferry Bridge, is omitted. All ranges except range No. 1 are maintained by the city of Philadelphia and are posts with diamond-shaped marks 4 or 5 feet square. In addition the channel as far as the Baltimore & Ohio Railroad Bridge is marked in places by buoys. Above this point chart 381 is the best guide. A black buoy off the mouth of **Mingo Creek** marks a rock with 8 feet over it. The bridges and the sharp bends in the river make it necessary for sailing and large vessels to employ towboats. **Anchorage** in Schuylkill River is prohibited except by permission of the commissioners of navigation.

Schuylkill navigation is a succession of short canals and slack-water pools following the course of the Schuylkill River from a point near Fairmount Dam, $7\frac{1}{2}$ miles above the entrance, to **Port Clinton**, a distance of about 80 miles. It is used mostly by canal boats, but is also frequented by many yachts and motor boats. The available depth throughout at low stage is about $4\frac{1}{2}$ feet. It has 55 locks, each 18 feet wide and 110 feet long. All of the bridges crossing the canal are fixed, the lowest being a bridge at **Norristown**, 21 miles above the mouth, which has a headroom of 13 feet at mean summer stage and 1 foot at flood stage. The canal is closed for about 4 months in winter.

League Island, at the junction of the Delaware and Schuylkill Rivers, is the site of a United States navy yard. The basin on the north side of the island and its entrance from Schuylkill River have been dredged to a depth of 30 feet, and are not open to general navigation. The channel northward of the island having its en-

trance from Delaware River has a depth of 6 feet and is used only by boats engaged in dredging operations.

Big Timber Creek, on the southeast side of Delaware River southward of Gloucester, has a depth of about 3 feet on the flats at the mouth and deeper water inside. Tugboats and barges of 6 feet draft go to the wharves at Westville. There is a drawbridge at the mouth and two drawbridges at Westville. The river is navigable at high water for several miles.

Gloucester is a city on the eastern side of Delaware River opposite the lower end of Philadelphia and the site of a shipbuilding plant. The depths at the wharves are 8 feet or less, the principal traffic being coal and building materials. A ferry runs to Philadelphia.

Newton Creek, on the eastern side of Delaware River between Camden and Gloucester, is crossed by three fixed bridges near the mouth and can be entered only by small boats.

Camden is an important manufacturing city on the eastern side of Delaware River, opposite Philadelphia; the two cities are connected by several lines of ferries. A suspension bridge to connect Philadelphia with Camden is under construction. The high water vertical clearance in midchannel will be 135 feet. There are several large shipbuilding plants located here.

Petty Island, eastward of the main channel at the northern end of the city of Camden, is $1\frac{1}{2}$ miles long, and is the site of several industrial plants. The channel eastward of Petty Island is principally used by the traffic to and from Cooper Creek, and has a least depth of 12 to 15 feet at the westerly entrance, which is generally used and is easy of access with the aid of the chart. It is crossed by a railroad drawbridge. The easterly entrance is a dredged cut 300 feet wide, with a least depth of about 13 feet, between two buoys which mark the ends of spits bare at low water extending from Fisher Point Dike and the northeast end of Petty Island.

Fisher Point Dike, extending nearly $\frac{3}{4}$ mile west-southwestward from Fisher Point, shows well above high water and is sparsely wooded to the end.

Cooper River, southward of Petty Island, has been improved by dredging a channel 12 feet deep and 70 feet wide across the flats at the mouth and $1\frac{1}{4}$ miles above the entrance. There is a depth of about 6 feet for a further distance of about 1 mile, and a depth of 2 feet at low water and 4 feet at high water to **Stoys Landing**, at the head of navigation $7\frac{1}{4}$ miles above the entrance. Vessels using the creek are tugboats and barges up to 12 feet draft to the industrial plants in the lower part, and small truck and pleasure boats in the upper part. There is a black buoy on the eastern side of the dredged channel at the entrance. Above the entrance the best water follows a general midcreek course.

Cooper River is crossed by seven bridges between the entrance and the head of navigation. The first four, all within a distance of 3 miles from the mouth, are drawbridges, having a least draw width of 37 feet and a least headroom of 4 feet at high water when closed. The others are fixed bridges with a least width of 52 feet and a least headroom of 7 feet at high water.

Tides.—The mean rise and fall of tides is 5.3 feet at Cooper Point, just outside the entrance, and 2 feet at Stoys Landing. High and

low water at Stoys Landing occur 2 hours and 15 minutes after high and low water at Cooper Point.

Regulations prescribed for Cooper River require that vessels propelled by machinery shall not proceed at a greater speed than 4 statute miles per hour while passing a plant engaged in dredging operations, and that the engine must be stopped while passing. The signal to the plant to lower the mooring lines is four short blasts in quick succession, given when about $\frac{1}{2}$ mile or about 5 minutes in time from the plant.

Philadelphia, foot of Chestnut Street, is 88 miles above Cape Henlopen. General information relating to the port is given on pages 40 to 44.

Wharves.—The wharves and piers on the Philadelphia side of Delaware River are numbered consecutively from the foot of Market Street northward to Port Richmond and southward to Greenwich Point. The wharves at Port Richmond are numbered independently. Cramps shipbuilding plant is just below Port Richmond.

The following are the depths of water at mean low water alongside of the important piers on the Philadelphia waterfront:

	Feet.
Philadelphia & Reading Railroad coal piers, Port Richmond	28-30
Philadelphia & Reading Railroad iron ore discharging pier	30
Philadelphia & Reading Railroad grain elevator	28-30
Philadelphia & Reading Railroad general cargo piers	28-30
Pennsylvania Railroad general and bulk cargo piers, vicinity Washington Avenue	26-30
Pennsylvania Railroad coal piers, Greenwich Point	28-30
Pennsylvania Railroad ore pier, Girard Point	28-30
Pennsylvania Railroad elevator, Girard Point	28-30
Philadelphia tide water terminal	35
Municipal piers in general use for loading and discharge of general and bulk cargo	28-33

The wharves on the Camden side are numbered consecutively from **Pavonia** southward to Newton Creek, except for the Pennsylvania Railroad wharves, which are numbered independently. The principal wharves have depths at the ends of 13 to 36 feet at Piers 46 to 51 in the southerly part of Camden, 12 to 21 feet in the vicinity of **Kaighn Point**, and 10 feet in the vicinity of **Cooper Point**.

DELAWARE RIVER ABOVE PHILADELPHIA.

The Delaware River is navigable for a distance of $24\frac{1}{2}$ miles above the Pennsylvania Railroad bridge at Philadelphia to the city of Trenton. It is crooked and has many bars and shoals, but has been improved by dredging a channel 200 feet wide and 12 feet deep from Philadelphia to Trenton. It is marked by buoys and by lighted ranges in the upper end and is easily followed with the aid of the chart. This stretch of the river is used extensively by yachts and is a favorite cruising ground.

Steamers of 6 to 9 feet draft make regular trips to all of the towns on the river between Philadelphia and Trenton, and there is also considerable trade on the river in steamers, schooners, and barges up to 14 feet draft to the industrial plants along the shores. Schooners take a tow at Philadelphia or below. The river is also the approach to the Delaware and Raritan Canal, which has its entrance at **Borden-**

town. Directions for the river from Bordentown to Philadelphia are given on page 236, under "Inside route, New York to Norfolk."

The Pennsylvania Railroad bridge, crossing the river 1 mile above Petty Island, has a center pier draw, each opening 120 feet wide, with a headroom of 50 feet at high water under either the draw when closed or the fixed spans.

Pensauken Creek, on the eastern side, $\frac{3}{4}$ mile above the railroad bridge, has a depth of about 3 feet at low water for a distance of 5 miles above the mouth, but is crossed by six fixed bridges, which limit the navigation to barges and motor boats. The first three bridges have a headroom of about 10 feet at high water and the others a least headroom of about 3 feet at high water.

Riverton is a town on the eastern side, $3\frac{1}{4}$ miles above the railroad bridge. There is a depth of 7 feet at the steamboat wharf. A ferry connects Riverton with Tacony.

Bridesburg, Tacony, and Torresdale are parts of the city of Philadelphia, 1, $2\frac{1}{2}$, and 6 miles, respectively, above the railroad bridge.

Frankford Creek, on the western side, $1\frac{1}{2}$ miles above the railroad bridge, has been dredged to a depth of 6 feet and width of 60 feet for $\frac{3}{4}$ mile above the mouth, and has a depth of 5 feet at high water for a further distance of about 2 miles. It is crossed by three drawbridges within a distance of 1 mile from the mouth and by several fixed bridges between the upper drawbridge and the head of navigation. Navigation is confined almost exclusively to the lower 1 mile, and the deepest draft entering is about 9 or 10 feet.

Pennypack Creek, on the western side, $4\frac{1}{2}$ miles above the railroad bridge, has a depth of about 6 feet at high water to a fixed bridge 1 mile above the entrance. It is used by tugboats and barges of 6 feet draft. The **Philadelphia House of Correction** is on the south side.

The **Philadelphia filter plant** is on the western side of the river, $\frac{3}{8}$ mile above the mouth of Pennypack Creek. A very tall chimney and a white cylindrical tower are prominent.

Rancocas River, on the eastern side of the Delaware River, $5\frac{1}{2}$ miles above the railroad bridge, has a depth of 7 feet for a distance of $4\frac{1}{2}$ miles above the mouth and 5 feet to the junction of the Lumberton and Mount Holly branches, $7\frac{3}{4}$ miles above the mouth. It is used by many tugboats and barges up to 10 feet draft and by one freight steamer of 7 feet draft, which goes as far as Hainesport, on the Lumberton Branch. The Lumberton Branch above Hainesport and the Mount Holly Branch are used only by small pleasure boats. The channel southwest of Hawk Island is marked by a lighted range and buoy. The channel of Rancocas River, above Bridgeboro especially, is very narrow and crooked, follows generally the ebb tide, bends back and forth between shoals, and is difficult, even with local knowledge. The drawbridges crossing the river below the fork are described with Delanco, Bridgeboro, and Bougher.

The channel from the fork to the town of **Mount Holly**, a distance of $4\frac{1}{2}$ miles, is nearly bare in places at low water and has a depth of about 3 feet at high water. A drawbridge with an opening 30 feet wide, and two fixed bridges with a least headroom of 8 feet at high water, cross the river at Mount Holly.

There is a depth of 3 feet at low water in the Lumberton Branch to the town of **Hainesport**, $2\frac{1}{2}$ miles above the fork, and about 4 feet at

high water for a farther distance of $2\frac{1}{4}$ miles to the town of Lumberton. Two bridges cross the Lumberton Branch at Hainesport. The highway bridge has a draw opening and the railroad bridge is fixed, but has sufficient headroom for small unmasted boats.

Riverside is a town on the south side of Rancocas River, $1\frac{1}{4}$ miles above the entrance. It has several factories and considerable business by water.

Delanco is a town on the north side of Rancocas River, $1\frac{1}{2}$ miles above the entrance. There are wharves on both the Delaware and Rancocas River water fronts. There is a railway here capable of hauling out boats of 50 feet length and 5 feet draft. Two center-pier drawbridges cross Rancocas River between Delanco and Riverside. Each opening in the highway bridge is 41 feet wide and in the railroad bridge 43 feet.

Bridgeboro is a village on the south side of Rancocas River, 3 miles above the mouth. A drawbridge with openings 45 and 50 feet wide crosses the river at this point.

Bougher is a village on the south side of Rancocas River, 7 miles above the mouth. A bridge having a center pier draw with a width of $50\frac{1}{2}$ feet in the south opening crosses the river at this point. The north opening is shoal.

Hawk Island is a marshy island, wooded in the center, at the junction of Delaware and Rancocas Rivers.

Mud Island, $\frac{3}{4}$ mile northward of Hawk Island, is a mud flat covered with marsh grass in summer and is partially submerged at high water. A channel used only by motor boats leads around the northwest side.

Beverly is a city on the eastern side, 9 miles above the railroad bridge at Philadelphia. The principal business by water is by the regular river steamers and a few coal barges. There is a depth of 9 feet at the steamboat wharf. A black standpipe is prominent.

Edgewater Park is a settlement of summer residences along the high bank eastward of Beverly. There are no wharves except for small motor boats.

Neshaminy Creek, on the northern side, $\frac{3}{4}$ mile east-northeastward of the standpipe at Beverly, has a depth of about 3 feet at the mouth and is used at high water by barges of 8 feet draft and by pleasure boats to the second bridge $1\frac{1}{4}$ miles above the mouth. It is crossed by two fixed bridges, under which barges and motor boats can pass.

Burlington is a city on the southern side of Delaware River, 12 miles above the railroad bridge at Philadelphia. It has several industrial plants, and considerable trade by water in steamers, schooners, and barges, the deepest draft being 15 feet. There is a depth of 12 feet at the public wharf, 400 yards westward of a broad standpipe. Water and coal can be obtained at the wharves. The city is connected with Bristol by a ferry, which in summer also makes landings at Burlington Island.

Burlington Island, just north of the city of Burlington, is high and sparsely wooded. The center of the island is occupied by a pleasure park (Burlington Island Park). There is a wharf on the northwest side opposite Bristol with a depth of 8 feet at the end, at which river steamers and motor boats land. The channel southeastward of the island has a depth of 7 feet, being shoalest at the upper end. Vessels

of 12 to 15 feet draft use the lower end as far as a pipe foundry, $\frac{3}{4}$ mile above the entrance, but the upper end is used only by motor boats.

Bristol is a town on the northwest side of the river, 13 miles above the railroad bridge at Philadelphia. It is the terminus of the Delaware & Lehigh Canal. The principal trade by water is by the regular steamer line. There is a depth of 12 feet at the wharves.

The entrance to the **Delaware & Lehigh Canal** is at the south end of the town of Bristol. It is navigable to **Easton** and **Mauch Chunk**, distant 52 and 94 miles, respectively, above the entrance, and is used principally by coal barges and an occasional motor boat and yacht. The locks are 90 feet long, 11 feet wide, and 6 feet deep.

Florence is a town on the south side of the river, 16 miles above the railroad bridge at Philadelphia. There is a large pipe foundry on the point at the bend of the river, at which schooners and barges load to a draft of 14 feet. The steamboat wharf, $\frac{3}{4}$ mile eastward of the bend, has a depth of 12 feet at the end.

Money Island, abreast the eastern end of Florence, is a wooded marsh. The channel northward of the island is bare at low water. **Roebling** is a town established in connection with a large wireworks $17\frac{1}{2}$ miles above the railroad bridge at Philadelphia. There is a depth of 10 feet at the clubhouse wharf and 12 feet at the wireworks wharf 400 yards above. There is considerable dredging for sand outside the dredged channel between Roebling and Newbold Island.

Newbold Island, $18\frac{1}{2}$ miles above the railroad bridge at Philadelphia, is high and sparsely wooded, and has a house on the northwest side. A dike extends 300 yards westward from the lower end. The channel eastward of the island is nearly bare at low water.

Fieldsboro is a town on the high bank on the east side of the river, $\frac{3}{4}$ mile above the upper end of Newbold Island. There are factories and a railroad yard close alongshore at the foot of the bank. The steamboat wharf has a depth of 10 feet at the end.

Bordentown is a town on the high bank on the east side of the river, 21 miles above the railroad bridge at Philadelphia. The principal trade by water is by the regular river steamers, and it is important as the outlet of the Delaware & Raritan Canal, which is described on page 230. There is a depth of $7\frac{1}{2}$ feet to the entrance of the canal. The channel is buoyed and leads eastward of the shoal extending $\frac{3}{8}$ mile south-southwestward of the point on the west side of the canal entrance. The end of the shoal is marked by a red and black buoy. There is a depth of 9 feet at the steamboat wharf. Gasoline and provisions are obtainable. Directions are given on page 236.

Crosswick Creek, at the north end of Bordentown, has a depth of about 3 feet for 3 miles above the mouth, but the channel is crooked and difficult. A fixed bridge, under which small boats can pass, crosses the creek at the mouth.

The dredged channel from Bordentown to Trenton is well marked by buoys and range lights, and is easily followed. A railroad bridge to have a center pier draw, each opening 120 feet wide, with a headroom of about 50 feet above high water, is under construction 1 mile below the wharves at Trenton.

Trenton, at the head of navigation, 24½ miles above the railroad bridge at Philadelphia, has two wharves at the lower end of the city, with a depth of 12 feet at the ends. A dredged channel 200 feet wide with a controlling depth of 12 feet leads along the water front to the railroad bridge, with a turning basin just below the bridge. The city wharf is at the head of the channel and has a depth of 12 feet alongside. There is also a city wharf near the lower end of the city used for handling low-grade freight, and a public landing for yachts. The mid river south of the railroad bridge has a depth of 3 to 4 feet and is used only as an anchorage for motor boats. There is no navigation above the bridge. The deepest draft of vessels going to the wharves are tugboats and coal barges drawing 10 feet.

Tides.—The mean rise and fall of the tides is 5.2 feet at Philadelphia, 4.9 feet at Burlington, 4.5 feet at Bordentown, and 4.2 feet at Trenton. Daily predictions for Philadelphia are given in the tide tables published annually by the Coast and Geodetic Survey.

Ice.—The river above Philadelphia is generally closed to navigation by ice for extended periods during January and February, and during severe winters navigation is practically suspended during these months. Ice seldom forms before January.

Freshets.—During March and April freshets of from 10 to 20 feet in height above mean low water may be expected at Trenton. The highest water level is reached during the breaking up of the ice in the spring, and rain freshets do not ordinarily cause a height of over 9 feet above mean low water. Unless accompanied by ice, freshets are not ordinarily dangerous to shipping. The highest freshet on record, occurring in 1903, reached a height above low water of 21.6 feet at Trenton, 19.6 feet at Bordentown, and 12.8 feet at Bristol.

Directions for Delaware River from Bordentown to Delaware City are given on pages 236 to 238, under the heading "Inside route, New York to Norfolk."

COAST FROM CAPE HENLOPEN TO CAPE CHARLES.

From Cape Henlopen the coast trends southward for 21 miles to Fenwick Island lighthouse and then trends south-southwestward for 96 miles to Cape Charles. The coast southward of Cape Henlopen is a chain of low sand beaches, backed by woods, and presents few characteristic features from offshore. There are few towns along the outer beach, and the most prominent marks are the lighthouses and Coast Guard stations. The only harbor of refuge between Delaware and Chesapeake Bays is Assateague Anchorage, 61 miles southward of Cape Henlopen. The inlets and interior waters are described under "Inside waters, Cape Henlopen to Cape Charles," following.

The only towns visible from offshore between Cape Henlopen and Cape Charles are the summer resorts of **Rehoboth**, **Bethany Beach**, and **Ocean City**, 4, 15, and 28 miles, respectively, southward of Cape Henlopen lighthouse. Rehoboth is distinguished by a standpipe, Bethany Beach is a small group of houses without prominent marks, and Ocean City is marked by a water tank and several other prominent objects.

The coast between Cape Henlopen and Cape Charles is fringed with broken ground, on which lumps with depths up to 6 fathoms are found for distances of 8 to 11 miles from shore. The latest information from the old surveys respecting the outlying shoals is shown on the charts. The principal ones to which names have been applied are mentioned in the following description. There are light vessels off the outer edge of the broken ground and deep-draft vessels keep outside of them.

Hen and Chickens Shoal, close inshore off Cape Henlopen, by the last survey, had a least found depth of 9 feet, and there was a channel westward of it with a least depth of 22 feet, seldom used except by small boats. Strangers should pass outside of it. At night a red sector in Harbor of Refuge lighthouse covers the shoal. A black buoy, lying nearly 3 miles south-southeastward of Cape Henlopen lighthouse, marks the south end of the shoaler part, but a bank with 4 to 5 fathoms extends 3 miles southeastward from the buoy; this extension is marked by a whistling buoy.

Fenwick Island lighthouse is a white tower. The light is occulting white (light 50 seconds, eclipse 10 seconds), 83 feet above the water, and visible 15 miles.

Shoals with depths of 5 fathoms or less extend 8 miles offshore eastward of Fenwick Island lighthouse. **Fenwick Island Shoal** had a least depth of 11 feet by the last survey and is marked on the west side by a black gas and whistling buoy. A spot with 5 fathoms over it and marked by a whistling buoy lies $10\frac{1}{2}$ miles 92° true (E. $\frac{7}{8}$ S. mag.) from Fenwick Island lighthouse.

Fenwick Island Shoal light vessel, 14 miles 98° true (ESE. $\frac{5}{8}$ E. mag.) from Fenwick Island lighthouse, has a red hull with a white band covering bulwarks and "Fenwick" on each side and two masts with a black lantern gallery at each masthead. The light is 56 feet above the water, group flashing white, 3 flashes every 12 seconds, visible 12 miles. A riding light (fixed white) is exhibited from the forestay. The fog signal is a siren, blast 3 seconds, silent 17 seconds. If the siren is disabled a steam whistle will sound the same characteristic. The submarine bell strikes "3" every 6 seconds. The station buoy, red nun, lies 800 yards northward and marks a wreck.

Isle of Wight Shoal, 7 miles 120° true (SE. $\frac{3}{4}$ E. mag.) from Fenwick Island lighthouse, had a least depth of 16 feet by the last survey and is marked on the western side by a horizontally striped buoy. A shoal with $3\frac{1}{2}$ fathoms on it lies about midway between Isle of Wight Shoal and Fenwick Island Shoal.

Little Gull Bank, $2\frac{1}{2}$ miles southeastward of Ocean City, has a least depth of 12 feet by the last survey. It is marked by a gas and whistling buoy lying $1\frac{3}{8}$ miles off the southeast side, and at the southwest end by a horizontally striped buoy.

Great Gull Bank, $2\frac{1}{2}$ miles southward of Little Gull Bank, had a least depth by the last survey of 16 feet at the southwest end and is unmarked. Numerous unmarked spots with less than 5 fathoms lie offshore between Great Gull Bank and Winter Quarter Shoal, as shown on the chart.

Winter Quarter Shoal, 11 miles 72° true (E. by N. mag.) from Assateague lighthouse, had a least depth of 12 feet by the last survey, and is marked on the southwest end by a horizontally striped buoy. There is a gas and whistling buoy 2 miles eastward of the shoal.

Winter Quarter Shoal light vessel, 20 miles 88° true (E. $\frac{1}{2}$ S. mag.) from Assateague lighthouse, has a straw-colored hull with "Winter-Quarter" on the sides, and two masts with a lantern gallery at the foremast head. The light (shown from the foremast) is group flashing white (flash 2 seconds, eclipse 3 seconds, flash 2 seconds, eclipse 13 seconds), 50 feet above the water, and visible 12 miles. A fixed white light will be shown from the main mast if foremost light is inoperative. A fixed white riding light to indicate heading of vessel is shown from the forestay. The fog signal is a chime whistle, blast 3 seconds, silent 57 seconds. If whistle is disabled, a bell will be struck by hand. The submarine bell strikes a group of 4 strokes every 15 seconds. A radio station receives and transmits messages.

Assateague lighthouse is a red tower. The light is fixed white, with a fixed red sector between $29\frac{1}{2}^{\circ}$ true (NE. $\frac{3}{4}$ N. mag.) and 61° true (ENE. mag.), 154 feet above the water, and visible 19 miles. The tower shows well above the trees surrounding it, and is the most prominent mark in the vicinity.

Assateague Anchorage, about midway between the entrances to Delaware and Chesapeake Bays, is extensively used as an anchorage by schooners, tows, and other small vessels, usually in heavy northerly weather. There are depths of 20 feet close west-southwestward of the western end of Fishing Point, sheltered from northerly and northeasterly winds, and depths of 9 to 18 feet inside the bight formed by Fishing Point, sheltered from all but southwesterly winds. A limited number of small vessels can find anchorage in the eastern part, sheltered from all winds, but this part is generally crowded in heavy weather.

Fishing Point is a bare sand spit and is extending rapidly northwestward. From 1908 to 1911 the rate of movement was 200 yards per year, and from 1911 to 1922 about 75 yards. The end of the point in 1924 was marked by Fishing Point light (flashing white with red sector covering Turners Lump). As the point is still moving northwestward, care must be taken by a stranger rounding the point at night not to approach too close to the light.

There are two fish factories, with prominent iron stacks, located on the north side of Fishing Point. There are depths of 12 feet alongside the wharves. To go to the eastern wharf pass northward of buoy No. 6. Coal is in stock for the fishing vessels, and water of inferior quality may be obtained.

The shoals southeastward and eastward of Fishing Point are subject to some change both in depth and position, and strangers should proceed with caution when in this vicinity. The off-lying shoals are fairly stable, and those southward of Fishing Point are moving slowly southward. The routes usually followed by coasting vessels in approaching and leaving Assateague Anchorage are given on page 29.

Vessels bound to Assateague Anchorage from **Winter Quarter Shoal light vessel** in heavy weather should shape a course to lead southward of the shoals with 4 to 5 fathom depths between the light vessel and Black Fish Bank, and keep in a depth of at least 5 fathoms until south-southwestward of the entrance.

From **Winter Quarter Shoal** gas and whistling buoy vessels can head for Black Fish Bank gas and whistling buoy, but should pass $\frac{1}{4}$

mile southward of it to avoid the south end of the shoal. Vessels entering around the south side of Turners Lump should pass at least $\frac{1}{2}$ mile south of the black bell buoy at its eastern end, and southward and at least 200 yards westward of the red buoy at its western end. In the daytime vessels can then steer northward to a position 100 yards eastward of the black bell buoy westward of Fishing Point, then head northward and round the point at a distance of 200 yards.

The channel leading westward of Chincoteague Shoals and about $\frac{1}{4}$ mile southward of the red buoys marking the south side of Ship Shoal is considerably used, and had a least depth of about 16 feet in 1915.

Approaching Assateague Anchorage from southward, the shore should be given a berth of at least 3 miles to clear areas of possible fish traps. A 28° true (NE. $\frac{7}{8}$ N. mag.) course heading for Assateague lighthouse will lead to the black and white bell buoy south-southwestward of Fishing Point light. At night this course leads along the eastern edge of the red sector in Assateague lighthouse. Pass 100 yards eastward of the bell buoy and steer northward, giving the end of the point a berth of 200 yards and selecting anchorage according to draft, the water shoaling gradually from 18 feet near the end of Fishing Point to 12 feet northward of buoy No. 6.

Porpoise Banks, 10 miles southward of Assateague Anchorage and the same distance offshore, is a broken area on which the least depths found were $5\frac{1}{2}$ to 6 fathoms, as shown on the chart. The banks have not been closely developed and should be avoided by deep-draft vessels.

Parramore Banks, extending 8 miles from shore off Wachapreague Inlet, is a broken area on which the least depths found are $3\frac{1}{2}$ to 4 fathoms, as shown on the chart. The banks have not been closely developed. A gas and whistling buoy, moored 15 miles $51\frac{1}{2}^{\circ}$ true from Hog Island lighthouse, marks the eastern end of the banks.

Hog Island lighthouse is a black skeleton tower. The light is flashing white (flash 3.5 seconds, eclipse 41.5 seconds), 180 feet above the water and visible 20 miles. There is a white unused lighthouse tower $\frac{1}{2}$ mile southward of the lighthouse.

Smith Island Shoal has a present depth of 23 feet, lying $7\frac{3}{4}$ miles 101° true (ESE. $\frac{1}{2}$ E. mag.) from Cape Charles lighthouse. It is marked by a red whistling buoy. Depths less than 30 feet extend 2 miles, and broken ground with least found depths of $5\frac{1}{2}$ to $6\frac{1}{4}$ fathoms extends $11\frac{1}{2}$ miles, northeastward from Smith Island Shoal, as shown on the chart.

Cape Charles light vessel, $3\frac{1}{4}$ miles southeastward of Smith Island Shoal buoy and 11 miles 103° true (ESE. $\frac{1}{4}$ E. mag.) from Cape Charles lighthouse, has a red hull with "Charles" on the sides, and one mast with black lantern and gallery. There is an occulting white light 50 feet above the water, and visible 12 miles. The fog signal is an air siren, blast 3 seconds, silent 17 seconds. If siren is disabled, a bell will be struck by hand. The submarine bell strikes a group of 2 strokes every 10 seconds. To show the heading of the light vessel, a fixed white light of 40 candlepower is shown from the forestay.

Cape Charles lighthouse is a white skeleton tower. The light is group flashing white, 180 feet above the water, and visible 20 miles. The light flashes 9 times every 60 seconds, thus: Four flashes, eclipse

6.5 seconds, five flashes, eclipse 25 seconds; each flash 1.2 seconds duration.

Smith Island, upon which the lighthouse is located, is low and sparsely wooded, and the lighthouse shows well above the trees surrounding it. There is a white unused lighthouse tower with a red band around the center, $\frac{5}{8}$ mile east-southeastward of Cape Charles lighthouse.

The shoals and channels on the northeast side of the entrance to Chesapeake Bay are described on page 127.

Fish weirs along the outside coast between Cape Henlopen and Cape Charles are limited by regulation to certain areas. The inner limit of the areas for the entire distance is approximately $\frac{1}{2}$ mile from shore. From just southward of Cape Henlopen lighthouse to abreast Rehoboth Beach Coast Guard station the distance of the outer limit from shore increases gradually from $\frac{1}{2}$ mile to $2\frac{1}{2}$ miles, is approximately $2\frac{1}{2}$ miles offshore from abreast Rehoboth Beach Coast Guard station to Little Gull Bank, and 2 miles from shore from this point to a position eastward of Fishing Point light, with a clear opening abreast Indian River Inlet, $1\frac{3}{4}$ miles wide at the inner end and $2\frac{1}{4}$ miles wide at the outer end.

Between Chincoteague Inlet and Sand Shoal Inlet the outer limit is approximately 3 miles offshore, varying somewhat with the topography, with open areas about $1\frac{3}{4}$ miles wide at the inner ends and wider at the outer ends in front of each inlet. Between Sand Shoal Inlet and Cape Charles, the only area in which fish weirs are allowed, is an area approximately $1\frac{1}{2}$ miles long and $\frac{5}{8}$ mile wide close in-shore just southward of Sand Shoal Inlet.

Tides.—The mean rise and fall of tides on the outside coast is about 4 feet, and high and low waters occur at approximately the same time as at Sandy Hook.

INLAND WATERS, CAPE HENLOPEN TO CAPE CHARLES.

The bays and connecting channels on the coast of Delaware, Maryland, and Virginia form a continuous inland waterway from Lewes, Del., southward to Cape Charles. There is at present no navigable entrance to the interior waters from outside between Cape Henlopen and Chincoteague Inlet, a distance of 61 miles, but southward of Chincoteague Inlet there are several inlets through which the inside waters can be reached. All of the inlets have shifting entrances, in some cases marked by buoys.

The inlets and interior waters give access to the villages and summer resorts on the beaches and the adjacent mainland. They are used by a large number of small craft engaged in the oyster and clam industry and inside and outside fishing, and by some pleasure boats. There is considerable freight business between points inside, and some coasting trade in sea food, wood, and lumber.

The north end of Rehoboth Bay is connected with Delaware Bay by a canal dredged 6 feet deep and 50 feet wide, except in the deep cuts, where it is 40 feet wide. This leads from just inside the mouth of Broadkill Creek (5 miles northwestward of Cape Henlopen) southeastward in Lewes Creek to Lewes, then by a canal southeastward to Gordon Pond, then southward through **Rehoboth Canal** to Rehoboth

Bay. In 1922 the controlling depth was 2½ feet. Shoaling had occurred at the entrance into Delaware Bay.

Supplies.—Gasoline, provisions, and water can be obtained at Lewes, Rehoboth, Ocean View, Ocean City, Franklin City, Chincoteague, Wachapreague, Broadwater, Willis Wharf, and Oyster. Coal can be had in limited quantities at Ocean City, Chincoteague, and at the fish factories at Assateague Anchorage. There is communication by telephone at all villages and by telegraph at the railroad stations.

Repairs.—There is a railway at Chincoteague capable of hauling out vessels of 180 tons, 90 feet length, and 7 feet draft, and shops for ordinary repairs to hulls and motors. There are also smaller railways at Ocean View, Ocean City, Acomac, Wachapreague, and Willis Wharf, capable of hauling out most of the boats frequenting those places.

Pilots.—There are no regular pilots for the inside passages or the inlets, but all of the local boatmen are competent pilots. In good weather there are often fishing boats outside the inlets, and strangers can obtain a fisherman for a pilot. There are no towns at the inlets from which a pilot may be obtained on signal, but a member from the Coast Guard station nearest the inlet will usually go out if a signal is set.

Bridges.—There are three fixed bridges crossing the canal between Indian River Bay and Little Assawoman Bay, with a least headroom of 8 feet. All of the other bridges have draw openings with sufficient width for any of the boats using the inside waters.

Communication.—Lewes, Rehoboth, Ocean City, and Franklin City have railroad communication. Points on the beaches from Ocean City southward can be reached only by boat. Points on the mainland adjacent to the interior waters can be reached from the railroad a few miles westward of them.

Ice.—The inside waters northward of Chincoteague Bay are usually closed to navigation by ice during ordinary winters. From Chincoteague Bay southward the waters tributary to the inlets are closed by ice during severe winters, but remain so for only short periods of time. The principal inlets are rarely closed by ice, and are used by local boats throughout the winter.

Tides.—In the inland waterways the tides are greatly affected by winds, both in time and height, westerly winds producing low water and easterly winds high water. In Assawoman, Isle of Wight, Sinepuxent, and Chincoteague Bays northerly and southerly winds drive the water to the ends of the bays. With strong winds of long duration the change in depth may be as much as 3 feet above or below the normal high or low water, respectively, and the time of high or low water may be accelerated or retarded by more than an hour.

There is no tidal range in the inside waters from Rehoboth southward to the north end of Chincoteague Bay, the only variation in water level being due to winds; this usually ranges from ½ to 1 foot, with a maximum variation of several feet after strong winds of long duration.

Under the following stations in Chincoteague Bay and Inlet are given the mean rise and fall and the time of high or low water after high or low water at Assateague Anchorage, Snow Hill Landing, 0.4 foot, 5 hours 30 minutes; Assacorkin Island, 0.4 foot, 3 hours 55

minutes; Franklin City, 1 foot, 2 hours 25 minutes; Chincoteague, 1.9 feet, 55 minutes; Chincoteague Point, 3 feet, 0 minute.

The mean rise and fall at Assateague Anchorage and at the entrances of the inlets southward is about 4 feet, and high and low waters occur at approximately the same time as at Sandy Hook. Along the inside waters between Chincoteague Inlet and Cape Charles the mean rise and fall is about 4 feet and high and low waters occur from 30 minutes to 1 hour, depending on the distance from the nearest inlet, after high and low waters at the inlets.

Currents.—The currents have considerable velocity in the inlets and the narrow channels connecting the inlets with the adjacent bays and sounds. No observations are available, but it is estimated that current velocities of as much as 3 knots may be experienced at times in places of maximum velocities. In the inland waters from Rehoboth southward to the north end of Chincoteague Bay there are no tidal currents, the only currents being due to winds.

Aids to navigation.—The more important of the navigable inlets are marked by buoys, but the channels are shifting and the buoys can not always be depended upon. Breakers form on the shoal areas even in ordinary weather and are often a good guide. Some of the more important interior channels are marked by beacons and lights, but most of them are marked only by bush stakes maintained by local authorities, which are of little use to a stranger. The sloughs leading through mud flats can best be followed at low water, when the shoals are visible. Strangers drawing near the limit of draft for the interior channels should take a pilot.

DIRECTIONS, INSIDE ROUTE REHOBOTH TO CAPE CHARLES.

The directions and description following are written for use with charts 1219, 1220, 1221, and 1222, published by the Coast and Geodetic Survey.

Rehoboth to Ocean View, distance $10\frac{1}{2}$ miles, least depth 4 feet.—From the head of the canal 1 mile westward of Rehoboth, the waterway follows the canal southward for $1\frac{3}{4}$ miles to Rehoboth Bay. The south end of the canal leads between two stone jetties and is marked by a light on the east side and a prominent white shanty on the west side.

From here the best water slightly favors the west side of Rehoboth Bay, passes about $\frac{1}{2}$ mile eastward of Piney Island, about 300 yards northeastward of Bluff Point (marshy and not marked), and close eastward and southward of the large island southeastward of it (marked by an old house in the center and a cedar thicket on the east end). The channel then passes through Big Ditch, the thoroughfare westward of Middle Islet, which lies between Burton Islands and Indian River Neck. Middle Islet is marked by a single tree and shanty.

From Big Ditch the waterway trends southwestward for 1 mile in Indian River Bay to avoid the shoals in its eastern part, then leads south-southeastward to White Creek, and then follows White Creek for $1\frac{1}{2}$ miles to the mouth of the canal at Ocean View. There are shoals, usually marked by bush stakes, marking off many of the points in White Creek.

Ocean View to Ocean City, distance 15 miles.—The least depth is about 2 feet.

The waterway leads from Ocean View southward through a canal crossed by 3 drawbridges to Little Assawoman Bay, then southward across the mouth of **Miller Creek**, passing westward of two grassy islets and eastward of a string of islets, and then close along the marsh on the west and south sides to the Narrows.

It favors the west side through the **Narrows**, keeping out of the bight, then leads southward, favoring the west side of **Little Assawoman Bay** to the thoroughfare connecting it with Assawoman Bay, passes through this thoroughfare and the eastern fork at its south end, and then favors the west side of **Assawoman** and **Isle of Wight Bays**. Close to the south side of **Isle of Wight Bay** and $1\frac{1}{4}$ miles southeastward of **Keyser Point** there are two low, grassy islands; the best water, about 2 or $2\frac{1}{2}$ feet, leads about $\frac{1}{4}$ mile northwestward of them, and then follows the shore through the narrow slough southward of them, and then favors the western side of **Sinepuxent Bay** to the drawbridges at Ocean City.

Ocean City to Chincoteague, distance 30 miles.—The least depth from Ocean City to the north end of Chincoteague Bay is $2\frac{1}{2}$ feet, and from there to Chincoteague is 5 feet.

From the drawbridges at Ocean City the best water favors the east side of **Sinepuxent Bay** for 400 yards, and then the west side for about $1\frac{1}{2}$ miles, until near the ruins of a pile jetty crossing the bay from **Coffin Point**. It leads through the eastern opening in the jetty, then in mid-channel until just northward of **Sandy Point**, and then favors the western side to **South Point**. For a distance of $\frac{3}{4}$ mile southward from **Sandy Point** the channel is narrow and lies about $\frac{1}{4}$ mile from the west shore.

The waterway rounds **South Point** at a distance of about 200 yards and follows the marsh northwestward at a distance of about 300 yards. There is a house and barn $\frac{1}{4}$ mile eastward of **Island Point**; pass about 150 yards southward of **Island Point**, and bring the house and barn astern on a westerly course until about $\frac{1}{2}$ mile from **Island Point**. Then head for **Robins Marsh** (covered by bushes) and pass $\frac{1}{4}$ mile eastward of it. Then head a little westward of **Big Bay Point** until about 1 mile from it, and then pass $\frac{1}{4}$ mile eastward of it. Pass about 250 yards off the southeast end of **Big Bay Point**, about $\frac{1}{4}$ mile westward of **White Rock** (bare at extreme low water and usually marked by bush stakes), and about $\frac{1}{4}$ mile eastward of **Assacorkin Island**. Pass about 200 yards eastward of the southeast end of **Mills Island**, and between the two largest islets southeastward of that point on a southwesterly course; shoals extending a short distance southward from these islets are sometimes marked by bush stakes.

Pass $\frac{1}{4}$ mile eastward of the island off **Long Point**, steer southwestward for $\frac{3}{4}$ mile, and then bring the railroad wharf at **Franklin City** astern and pass 200 to 300 yards westward of light No. 4. Then head for light No. 5, pass close eastward of it, and head for a position about 200 yards northwestward of **Killick Shoal** lighthouse (white dwelling on piles). Pass 75 yards southwestward of the lighthouse and follow the curve of the channel, passing southwest-

ward of light No. 2 and eastward of lights Nos. 3 and 1, to the wharves at Chincoteague.

Chincoteague to Wachapreague Inlet, distance 33 miles.—The least depth is not more than 1 foot at mean low water, and it often goes bare in places. There is 3 or 4 feet at mean high water, and it is only used at half tide or higher. The deepest draft using it is 4 feet and usual draft 2 or 3 feet. Navigation is difficult, and local knowledge is necessary. The shoalest places are found in Kegotank, Metomkin, Cross Broad Water, and Floyds Bays. Boats from Chincoteague southward can carry the best water by leaving on the last of the ebb tide, and from Wachapreague northward by leaving about 2 hours after the beginning of the flood. A little deeper draft can be carried northward than southward on a single tide. A drawbridge crosses Chincoteague Channel at Chincoteague; width of openings, 55 feet, with 18 feet headroom at low water.

From the wharves at Chincoteague the waterway follows **Chincoteague Channel** southwestward until about $\frac{3}{8}$ mile southward of the point of marsh on the east side of Queen Sound, then north-northwestward across the middle ground with a shanty on Chincoteague Island astern, then follows the western channel southwestward as shown on the chart to **Ballast Narrows**. It leads westward through **Ballast Narrows**, through **Island Hole Narrows**, and then in a dredged channel across **Bogues Bay** and through **Cat Creek**; the dredged channel is marked by spoil banks. At the south end of Cat Creek the waterway follows the easternmost narrow slough to **Hog Creek**, and down the latter to **Assawaman Inlet**.

From **Assawaman Inlet** the waterway leads northwestward in **Assawaman Creek** for $\frac{1}{2}$ mile, then westward through a short cut-off, and then follows the most westerly thoroughfare, as shown on the chart, to the northwest end of **Kegotank Bay**. It passes westward of an islet on the west side of **Kegotank Bay**, and then leads southeastward across the bay to the easternmost narrow slough at its south end. It then follows this slough and **North Gargathy Creek** southward to **Gargathy Inlet**, and **South Gargathy Creek** westward and southwestward to **Metomkin Bay**. There is a shanty on the west side of the thoroughfare at its outlet into **Metomkin Bay**.

The best water leads westward of two islets just after entering **Metomkin Bay**, then southeastward for about $\frac{1}{4}$ mile, then favors the east side of the bay and passes through the eastern slough in its southern part, as shown on the chart, to **Metomkin Inlet**. From here it leads westward through **Longboat Creek**, through the middle of **Cross Broad Water** to its south end, westward through **Teagles Ditch**, southwestward near the middle of the north part of **Floyds Bay** for 1 mile, and then in the slough near its west side, as shown on the chart, to the north end of **Hummock Channel**, and then southward in the latter to the entrance of **Finney Creek**, which leads to **Wachapreague**. The waterway continues southward through **Black Rock Reach**, then eastward for $\frac{3}{4}$ mile, and then southward across **Wachapreague Inlet**, following the marsh on its west side to avoid the middle ground shown on the chart.

Wachapreague Inlet to Great Machipongo River, distance 15 miles, least depth 3 feet at low water and about 6 feet at high water.—The shoalest place is at the south end of **Drawing Channel**, and the deep-

est draft will be carried across this point by leaving Wachapreague Inlet at high water. The channels are difficult, and local knowledge is required to avoid the shoals. From Wachapreague Inlet the waterway leads southward along **Horseshoe Lead** and **Drawing Channel**, then westward and southward through the **Swash** and **Little Sloop Channel** to **Sandy Island Channel**. From here the more direct route, good for a depth of about $2\frac{1}{2}$ feet, leads southwestward along **Sloop Channel** and southeastward along **Cunjer Channel** to **North Channel**; but the deeper and more generally used passage leads southeastward along **Sandy Island Channel** to **Little Machipongo Inlet**, then southwestward and westward along **North Inlet** and **North Channel** to **Great Machipongo River**. **North Channel** and **Great Machipongo River** are marked by lighted beacons.

Great Machipongo River to the southwest end of **Smith Island**, distance 30 miles, least depth about 6 feet.—The shoalest part is through the **Ramshorn**, which is very narrow and difficult and can be followed only at low water when the flats show above water. All of the channels are more easily followed at low water.

From the intersection of **North Channel** and **Great Machipongo River** the waterway leads southward for $3\frac{1}{2}$ miles to the western branch, and then westward through this branch and the **Deeps** to the **Outlet**. From here a draft of $2\frac{1}{2}$ feet can be carried southwestward through the **Outlet** and into the **Thoroughfare**, as shown on the chart; but the deeper and more generally used channel leads westward along the **Deeps**, then northwestward, northward, and southwestward into the **Thoroughfare**, following the channel lying nearest to the mainland. This part of the waterway is known as the **Ramshorn**.

From here the waterway leads southward through the **Thoroughfare** and the channel in **Magothy Bay** to the southwest end of **Smith Island**, as shown on the chart. There is a light at the intersection of **Sand Shoal Channel** and the **Thoroughfare**, and single pile beacons with daymarks at frequent intervals between there and **Smith Island**. Boats can leave the waterway through **Smith Island Inlet**, which has a depth of 4 feet at low water and about 7 feet at high water, or through **Fisherman Inlet**, which has a depth of about 4 feet at high water. Further information is given on page 92.

REHOBOTH TO CHINCOTEAGUE BAY.

Rehoboth is a summer resort with railroad communication, on the beach $3\frac{1}{2}$ miles southward of **Cape Henlopen lighthouse**. In summer motor boats run to **Ocean View** and **Bethany Beach**. A black standpipe is the most prominent mark.

Rehoboth Bay has a depth of 4 to 7 feet and is much frequented by boats of 3 to 4 feet draft running produce and wood products from the tributaries of **Rehoboth** and **Indian River Bays** to **Rehoboth** for shipment. There is a landing, to which a depth of 4 feet can be carried, at the northeast end, westward of **Rehoboth Beach Coast Guard station**. There is no tidal effect, but the water level is changed from $\frac{1}{2}$ to $1\frac{1}{2}$ feet by winds.

Love Creek, at the northwest end of **Rehoboth Bay**, is navigable for small boats to a milldam near the village of **Robinsonville**, $3\frac{1}{2}$

miles above the mouth. It is crossed by a fixed bridge, under which motor boats without houses can pass.

Herring Creek, at the southwest end of Rehoboth Bay, is navigable with a draft of about $2\frac{1}{2}$ feet to the fork, about 2 miles above the mouth, and with a less draft for a short distance up either fork. It is little used. **Angola** is a post village near the head of navigation.

Indian River Inlet, $9\frac{1}{2}$ miles southward of Cape Henlopen lighthouse, was closed in 1922.

Indian River Bay has general depths of 6 or 7 feet, except along the eastern end, which is shoal. It is used by boats bound north or south along the waterway and by local boats carrying produce and wood products to Rehoboth or Millsboro. The usual draft of boats is 2 to 4 feet.

Indian River, at the west end of Indian River Bay, has a depth of $3\frac{1}{2}$ feet in mid-channel to the milldam at Millsboro, the upper $1\frac{1}{2}$ miles being a privately dredged channel. **Millsboro** is a town on the railroad $5\frac{1}{2}$ miles above the mouth.

Pepper Creek and **Vine Creek**, on the south side at the western end of Indian River Bay, have a depth of 3 feet for about $1\frac{1}{2}$ miles above their junction; they have several farm and mill landings.

White Creek, on the south side of Indian River Bay, has a depth of about 4 feet to **Ocean View**, a village at its head 2 miles above the mouth. It forms a part of the inland waterway.

A canal, dredged to a width of 20 feet and depth of 4 feet, but shoaled to 2 feet, connects White Creek with the north end of Little Assawoman Bay.

Bethany Beach is a small summer resort on the beach, 2 miles southeastward of Ocean View and $4\frac{1}{2}$ miles northward of Fenwick Island lighthouse. A privately dredged channel, marked by spoil banks, leads from the canal eastward through Salt Pond to near the beach. It had a depth of 2 feet in 1914 and this depth could be brought to it from Indian River Bay. In summer motor boats run to Ocean View, Millsboro, and Rehoboth.

Little Assawoman Bay has depths of 2 to 4 feet and is little used. It is covered with grass in summer, which is an obstruction to navigation for boats not equipped with weedless propellers. **Miller Creek** and **Derickson Creek**, on the west side of the bay, have a depth of $1\frac{1}{2}$ feet for about $1\frac{1}{2}$ miles above their mouths and are little used. Little Assawoman Bay and Assawoman Bay are connected by a narrow thoroughfare having a least depth of about 7 feet; it is crossed by a highway drawbridge; width of draw span, 33 feet. **Bayville** is a post village $1\frac{1}{2}$ miles northwestward of the bridge.

Assawoman and Isle of Wight Bays have general depths of 4 to 6 feet along their western sides, but only 2 feet can be brought to them from north or south. They are frequented by pleasure boats from Ocean City and by boats engaged in traffic between points on the tributaries.

Roy Creek and **Grey Creek** have depths of 3 feet nearly to their heads but are little used.

St. Martin River, on the northwest side of Isle of Wight Bay, has a depth of about 3 feet to the fork, $3\frac{1}{2}$ miles above the mouth, and 2 feet to the post village of Bishopville, at the head of navigation on the north branch (**Bishopville Prong**) $2\frac{1}{2}$ miles above the fork.

It is crossed by a drawbridge about 1 mile below Bishopville. The west branch, called **Shingle Landing Prong**, is said to be navigable for small boats for $1\frac{1}{2}$ miles.

Sinepuxent Bay has depths of 3 to 5 feet; it can be entered from northward with a draft of 2 feet and from southward with a draft of $2\frac{1}{2}$ feet. It is frequented by fishing and pleasure boats and boats bound north or south along the inland waterway. The ruins of a pile jetty cross the bay $1\frac{3}{4}$ miles southward of Ocean City; the eastern opening is the best.

Bridges.—A railroad center-pier drawbridge and highway lift bridge cross Sinepuxent Bay at Ocean City; width of openings, 34.5 and 40 feet; height above mean low water, 5 feet (railroad bridge). The following are regulations prescribed for the railroad bridge:

1. Between 6 a. m. and 10 p. m. daily the drawbridge shall be opened within 5 minutes after any boat entitled to opening has signaled, except as provided below. At other times the drawbridge shall be opened as soon as practicable.

2. Signal for opening shall be given by three blasts on a horn or steam whistle and shall be recognized by the bridge tender by the waving of a red flag by day or a red lantern by night.

3. The drawbridge shall be opened for the passage of all boats that can not pass under the bridge. Boats that can pass under the bridge by unstepping masts of 4 inches or less diameter shall not be entitled to have the drawbridge opened, unless the mast is permanently stepped in the boat or permanently attached thereto by stays or guys.

4. Boats unprovided with proper horns for signaling shall notify the bridge tender in any convenient manner, and the draw shall be opened as soon as practicable after the notification is received.

5. The drawbridge shall not be opened or allowed to remain open for passage of boats within 10 minutes of expected arrival of scheduled trains.

Ocean City is a summer resort with railroad communications, $7\frac{1}{2}$ miles southward of Fenwick Island lighthouse. It is frequented by many small boats in summer, and is the shipping point for a large amount of sea food and produce. A water tank is prominent.

CHINCOTEAGUE BAY AND INLET.

Chincoteague Bay, about 20 miles long, has depths of 5 to 7 feet along its western side and is shoal along its eastern side. There are depths of 2 to 3 feet at its junction with Sinepuxent Bay. It is frequented by a large number of boats up to 6 feet draft, engaged in the oyster, clam, and fishing industry. There is also considerable freight business between points on the bay and adjacent waters. There are several small landings on the western side of the bay northward of Franklin City.

Newport Creek, at the north end of Chincoteague Bay, is said to be navigable with a draft of 2 feet for about 6 miles to within $1\frac{1}{2}$ miles of the town of Berlin.

Franklin City is a village and railroad terminal on the west side of Chincoteague Bay, $3\frac{1}{2}$ miles northward of Killick Shoal lighthouse. It is the shipping point for the sea food and produce of this vicinity. A draft of $4\frac{1}{2}$ feet can be carried to the wharves from southward. Boats run regularly to Chincoteague. Two white church spires are prominent.

Chincoteague is a town on the west side of Chincoteague Island, southeastward of Killick Shoal lighthouse. It is the center of most of the oystering and fishing industry in this vicinity, and has boat

connection with the railroad at Franklin City. There are depths of 5 to 8 feet at the wharves, where all kinds of supplies are obtainable. There is a drawbridge connecting Chincoteague with the mainland; width of openings, 55 feet.

Chincoteague Inlet, the first navigable inlet southward of Cape Henlopen, had a depth in 1922 of about 5 feet in the buoyed channel, as shown on the chart. It is used by many boats, the largest being schooners and barges of 8 feet draft carrying oysters and coal. The shore line and channels in the vicinity of the inlet are subject to rapid change, and the outer buoys do not always mark the best water. Assateague lighthouse and the two fish factories on the southeast side of Assateague Anchorage are the prominent marks in approaching the inlet. Pilots for the inlet can usually be obtained at the fish factory or from one of the Coast Guard stations in the vicinity. There is good anchorage anywhere in the channel inside of Chincoteague Point.

Assateague Anchorage is described on page 78.

Assateague Inlet, the channel eastward of Chincoteague Island, has a depth of $2\frac{1}{2}$ feet at its south entrance and deeper water inside. The north entrance is shoal and not used.

Wire Narrows, **Queen Sound**, and **Cockle Creek** have good depths into them from southward, but are shoal at their outlets into Chincoteague Bay. They are used only by small oyster boats.

CHINCOTEAGUE INLET TO GREAT MACHIPONGO INLET.

Watts, **Powells**, and **Bogues Bays** are shoal; a draft of 4 to 5 feet can be carried to them through **Roots**, **Ballast**, and **Island Hole Narrows**.

Wishart Point is a landing on the mainland between **Powells** and **Bogues Bays**. A draft of about 4 feet can be carried to the wharf at low water through **Ballast Narrows**. It is connected with Chincoteague by daily (except Sunday) mail boat.

A channel, dredged to a depth of 4 feet and marked by spoil banks, leads from the south end of **Island Hole Narrows** across **Bogues Bay** and through **Cat Creek**.

Assawaman Inlet, 5 miles southwestward of Chincoteague Inlet, had a depth across the bar in 1914 of about 2 feet. The channel is unmarked, is changeable in depth and position, and is seldom used; there are usually breakers across the entrance.

Assawaman Creek, leading northwestward from the inlet, is navigable for small boats for about $3\frac{1}{2}$ miles.

Kegotank Bay has a depth of about 1 foot at low water and frequently goes bare over most of its area at extreme low water. There is about 4 feet at high water.

Gargathy Inlet, 9 miles southwestward of Chincoteague Inlet, had a depth across the bar in 1914 of about 2 feet. It is not marked, is changeable, and used only by an occasional small local boat. The appearance of the water is the best guide.

Kegotank Creek, leading northwestward from Gargathy Inlet, is navigable for small boats at high water for about 4 miles to within about 1 mile of the village of Modest Town.

Metomkin Inlet, 15 miles southwestward of Chincoteague Inlet, had a depth across the bar in 1922 of about 5 feet. It is used by some local fishing and oyster boats up to 6 feet draft. The channel is

marked by buoys, but is changeable, and strangers should not attempt to enter without a pilot. The Coast Guard station on the north side of the inlet is the only mark in approaching.

Metomkin Bay has several sloughs with depths of 6 to 10 feet leading northward from the inlet, but the north end has a general depth of only 1 to 2 feet. The best water in the north end of the bay leads along its eastern side.

Folly Creek, leading westward from the south end of Metomkin Bay, is said to have a depth of 3 feet at low water to the landing at its head, 3 miles above the mouth and 1 mile from **Accomac**, a town on the main highway.

Longboat Creek, leading westward from Metomkin Inlet, has a least depth of about 9 feet.

Cross Broad Water, 2 miles southwestward of Metomkin Inlet, can be crossed with a least depth of $1\frac{1}{2}$ feet at low water and about 5 feet at high water. It is connected with the north end of Floyds Bay by **Teagles Ditch**, which has a least depth of 12 feet.

Floyds Bay, extending northward from Wachapreague Inlet, has several sloughs with good water leading northward from the south end, terminating in shoals at the north end. **Hummock Channel**, marked on the east side by a row of oyster houses on small grassy islets, is the most important. It has a depth of 20 feet at its south end, gradually shoaling to a general depth of about 1 foot in the north end of the bay.

Wachapreague is a post village on the west bank of **Finney Creek**, 4 miles west-northwestward of Wachapreague Inlet. It is the center of most of the oystering and fishing industry in this vicinity and is frequented by some pleasure boats in summer. A draft of about 10 feet can be carried from Wachapreague Inlet through **Black Rock Reach** and **Finney Creek** to abreast the wharves. A white church spire is prominent from eastward with the sun on it.

Wachapreague Inlet, 20 miles south-southwestward of **Chinco-teague Inlet** and 12 miles north-northeastward of **Hog Island** lighthouse, had a depth in 1922 of 7 feet in the main buoyed channel, which led northward and westward, as shown on the chart. It is used by many local fishing and oyster boats and a few boats entering for shelter. The deepest draft entering is 10 feet, and the usual draft 3 to 6 feet. Strangers should take a pilot, as the channel is shifting and the buoys do not always mark the best water.

The old and new Coast Guard stations, a hotel, and several houses, all on the north side of Wachapreague Inlet, are the most prominent marks in approaching. A clubhouse and windmill on the point of marsh 1 mile northwestward of the entrance are also prominent. There is a wharf at the Coast Guard station just inside the entrance.

The best anchorage is in **Horseshoe Lead**, southwestward of the entrance, where there is a depth of 20 to 36 feet along the east side of the channel. There is a middle ground inside the inlet and northwestward of the entrance; the best water leads eastward and northward of it.

The open waters northwestward of the beach between Wachapreague Inlet and **Little Machipongo Inlet** are mud flats bare at low water, with sloughs leading through them, and are used only by local fishing and oyster boats. A channel has been dredged by

private enterprise to a depth of 3 feet along the south end of **Drawing Channel** to the **Swash**, and forms a part of the inside route.

Little Machipongo Inlet, $4\frac{1}{2}$ miles north-northeastward of **Hog Island** lighthouse, had a depth across the bar in 1922 of about 10 feet. It is not marked and is used only by local boats of 5 or 6 feet draft. A house on the point of beach on the south side of the inlet and a windmill and clubhouse on the southeast side of **Revel Island** are the only marks visible in approaching the inlet. The appearance of the water is the best guide in entering, but strangers should not enter without a pilot.

Quinby is a small post village on the mainland about $5\frac{1}{2}$ miles north-northwestward of **Little Machipongo Inlet**. A draft of 6 feet can be carried to within $1\frac{1}{2}$ miles of it, and the remaining distance is navigable only for small boats at high water.

Broadwater is a post village of oystermen and fishermen on **Hog Island** near the lighthouse. A draft of about 6 feet at low water can be carried to abreast the village from southward through **Heather Channel**, and about 4 feet at high water from the northward through a crooked unmarked slough leading southward from **North Inlet**, 2 miles southwestward of **Little Machipongo Inlet**. There is a privately dredged basin for small boats west-southwestward of **Hog Island** lighthouse, on which all of the landings are located; the depth is about 3 feet. **Broadwater** is connected by boat with **Willis Wharf**.

GREAT MACHIPONGO INLET TO CAPE CHARLES.

Great Machipongo Inlet, 2 miles southward of **Hog Island** lighthouse, had a depth across the bar in 1922 of about 15 feet in the buoyed channel, which led westward into the inlet approximately as shown on the chart. Breakers form on the bar only in heavy weather, but form on the shoals on each side at all times. While the inlet is not subject to radical change with every gale, it has a slow but steady change from year to year and no permanent directions can be given. The usual draft of boats using the inlet is 5 or 6 feet, and the deepest draft 14 feet. The prominent marks in approaching the inlet are **Hog Island lighthouse** and the old tower $\frac{1}{2}$ mile southward of it.

Great Machipongo River, leading westward and northward from **Great Machipongo Inlet**, has a least depth of about 17 feet for 12 miles above the inlet to the mouth of **Parting Creek**, about 6 feet for a further distance of 5 miles, and is navigable by small boats at high water for a considerable distance farther. For a distance of $9\frac{1}{2}$ miles from the inlet it leads through mud flats bare at low water. It is marked by buoys and lights, as shown on the chart, but can best be navigated at low water, when the flats show above water. The best water leads eastward of the large island just after entering the mainland. There is little business above the mouth of **Parting Creek**.

Willis Wharf is a village on the west side of **Parting Creek**, 1 mile above its junction with **Great Machipongo River** and 13 miles by water from **Great Machipongo Inlet**. It is $1\frac{1}{2}$ miles from the railroad station of **Exmore**, and is the shipping point for most of the sea food taken in this vicinity. A draft of 3 feet can be brought

to the wharves at low water, and schooners loaded to 8 feet leave at high water. In entering the mouth of Parting Creek favor the north side to avoid a shoal area about in midstream. The best water leads southward and westward of the island $\frac{1}{2}$ mile above the mouth, then favors the west side to the wharves.

There are several sloughs leading from Great Machipongo River southwestward to Sand Shoal Channel. A draft of about $3\frac{1}{2}$ feet at high water can be carried from Great Machipongo Inlet southwestward in **Rowes Hole Channel**, then south-southwestward between two large islands and through **Loon Channel** to Sand Shoal Inlet. It is unmarked and local knowledge is required to follow it.

A draft of about 2 feet at low water and 5 feet at high water can also be carried up **Gould Marsh Channel**, through a narrow slough into **Eckichy Channel**, and down this to Sand Shoal Channel.

The best and most generally used channel is the most westerly one, leading through the **Deeps** and the **Ramshorn** to the north end of the **Thoroughfare**, as described in the directions for the inside route preceding.

Sand Shoal Inlet, $7\frac{1}{2}$ miles southwestward of Hog Island lighthouse and $11\frac{1}{2}$ miles northeastward of Cape Charles lighthouse, had a depth in 1922 of about 13 feet through the northeast channel, which is marked by buoys and a lighted range. The range does not mark the best water. While the inlet is not subject to radical changes with every gale, it has a slow but steady change from year to year and no permanent directions can be given. The southeast and south channels are used to some extent by local boats, but are unmarked and should not be attempted by a stranger. The usual draft of boats using the inlet is 5 or 6 feet and the deepest draft about 14 feet. The Coast Guard station and a hotel on the south end of **Cobb Island**, and two houses on the north end of **Wreck Island**, are the only marks visible in approaching the inlet.

Loon Channel, leading northward from Sand Shoal Inlet close to Cobb Island, can be entered with a draft of about 8 feet. It has a depth of about 20 feet off the Coast Guard station and is a good boat anchorage.

Sand Shoal Channel, leading westward from Sand Shoal Inlet, has a least width of $\frac{1}{4}$ mile and a least depth of 30 feet in mid-channel for 5 miles westward from the inlet to its junction with the **Thoroughfare**. It is marked by buoys, lights, and beacons, as shown on the chart, and is easily followed.

Oyster is a post village on the mainland 1 mile westward of the intersection of Sand Shoal Channel and the **Thoroughfare**. It is 2 miles from the railroad station of **Cheriton**, and is the shipping point for a large amount of sea food. It can be reached through a narrow crooked slough, bare at low water and having a depth of about $4\frac{1}{2}$ feet at high water. The entrance is about $\frac{1}{2}$ mile northwestward of the light at the intersection of Sand Shoal Channel and the **Thoroughfare**.

New Inlet, 9 miles northeastward of Cape Charles lighthouse, is shoal and unmarked, is very changeable, and is seldom used even by local boats. A draft of about 6 feet at high water can be carried from the inlet southwestward and southward into Ship Shoal Chan-

nel; small boats can also pass westward along **Great Drum Drain** and northward along **Man and Boy Channel** to Sand Shoal Channel.

Ship Shoal Inlet, 7 miles northeastward of Cape Charles lighthouse, had a depth across the bar in 1921 of about 6 feet. It is unmarked and is used only by local oyster boats of 3 to 5 feet draft. There is deep water inside but no connection with the main waterways, except for small boats. A draft of about 2 feet at low water can be carried along **Ship Shoal Channel** and through a very crooked slough through the flats to the **Thoroughfare**, westward of Cape Charles lighthouse.

Little Inlet, $5\frac{1}{2}$ miles northeastward of Cape Charles lighthouse, had a depth of about 3 feet in 1921; it is unmarked and is used only by a few local boats of 2 or 3 feet draft. Small boats can pass from Little Inlet to Ship Shoal and Smith Island Inlets at high water only.

Smith Island Inlet, entering 2 miles south-southwestward of Cape Charles lighthouse, had a depth in 1921 of about 4 feet. The channel is buoyed, but is narrow, is subject to rapid change, and the buoys can not always be depended upon. It is the southern outlet to the inside waters, and is used by many local boats of about 3 to 6 feet draft, carrying sea food to Norfolk, Cape Charles, and other points.

Fisherman Inlet, entering westward of Cape Charles lighthouse, has a depth of about 1 foot at low water and 4 feet at high water; it is used by many boats of 2 or 3 feet draft, and is preferred to Smith Island Inlet when the depth is sufficient, as it has ample width and is protected from heavy seas. There is a perpendicularly striped buoy at the western entrance. From here the best water follows the channel northeastward close along the south point of the mainland, then east-southeastward across the flats to the channel of Smith Island Inlet.

Magothy Bay, extending 7 miles northward from Smith Island Inlet, is shoal except in the main channel, which has a least depth of about 9 feet from Smith Island northward to Sand Shoal Channel. The channel is marked at frequent intervals by single pile beacons with day mark, but can best be navigated by a stranger at low water, when the flats show above water.

Magotha is a post village on the mainland about 3 miles northwestward of Cape Charles lighthouse. A draft of about 3 feet at high water can be carried to the wharf through a narrow slough leaving the main channel just northward of Long Point Island.

There is a long wharf on the northwest side of **Smith Island** abreast the lighthouse, to which a depth of 6 feet can be carried from southward.

CHESAPEAKE BAY.

Chesapeake Bay is 170 miles long from the entrance to the mouth of Susquehanna River at the head. It is the approach to the seaports of Baltimore, Norfolk, Newport News, and many other important cities, and has a large trade carried in foreign and domestic vessels. It is also the center of a large oystering and fishing industry.

The main entrance is between Cape Charles on the north and Cape Henry on the south. It can also be entered from Delaware

River by vessels of 9 feet draft through the Chesapeake & Delaware Canal, at the north end of the bay; and from Albemarle Sound by vessels of 9 feet draft through the Dismal Swamp Canal, and 9.6 feet draft (in 1923) through the Albemarle & Chesapeake Canal, both connecting the inside waters southward with the Chesapeake Bay at Norfolk.

The shores of the bay from the south end northward to Patuxent River entrance on the western side and to Chester River entrance on the eastern side are generally low and present no prominent features. Above these points they are hilly and generally wooded, rising to a considerable height in the vicinity of Northeast and Susquehanna Rivers.

The most important tributaries on the western side are generally broad and deep at their entrances, are navigable for long distances, and have a large general trade. Those on the eastern side are generally shoal at the mouths and have little coasting trade, but are frequented by many vessels engaged in the bay trade.

Channels.—The main channel of Chesapeake Bay has a least depth of 35 feet from the entrance to Baltimore, a distance of 149 miles. It follows the natural channel of the bay from the entrance to Sandy Point, 21 miles below Baltimore, except through the new York Spit Channel, which is a dredged cut 35 feet deep and 1,000 feet wide, but is not used except by deep-draft vessels. This channel is restricted by regulation to vessels passing up or down the bay. It is unlawful for any vessel to cross the channel or to enter it at any other point than at the ends and in the direction of its axis, after which the channel must be followed for its entire length. The limits of the channel are marked by gas and spar buoys. From Sandy Point to Baltimore it leads through a dredged channel. The channel in the bay has ample width, is well marked, and easy of navigation either by day or night. It leads close to middle grounds just inside the entrance, but above the midchannel is clear, though shoals make off for a long distance from many of the points.

Pilots.—Pilotage is compulsory between Chesapeake Bay entrance and Smith Point, Yorktown, Newport News, Norfolk, or any intermediate point, for all vessels other than vessels exclusively engaged in the coastwise trade and those made exempt by United States statutes, if spoken outside of a line with Cape Henry bearing south. Pilotage is also compulsory for foreign vessels and vessels from a foreign port and all vessels sailing under register, bound to and from Baltimore, except vessels employed in and licensed for the coasting trade and American vessels laden either in whole or in part with coal or coke mined in the United States.

Virginia pilots are taken to any port in Virginia, and Maryland pilots to any port in Maryland. Two pilot steamers will usually be found cruising outside the entrance of the bay, except when one goes in for supplies, at which time both Virginia and Maryland pilots are aboard one steamer. The night signal for a Virginia pilot is one long and one short blast of whistle, and for a Maryland pilot three long and one short blasts. Vessels bound up the Potomac usually take a Maryland pilot, if any, who on reaching the river turns the vessel over to a river pilot or takes the vessel up himself. The pilotage fees in either case are the same to Washington as to the port of Baltimore. Pilots for the smaller tributaries of the bay are oystermen or fisher-

men living in the vicinity, and can be obtained from boats at work near the entrances or on signal from shore.

The fees for piloting to or from Smith Point, Yorktown, Newport News, or Norfolk or intermediate points are as follows:

For every vessel drawing—	Per foot.
Under 8 feet.....	\$2. 00
8 feet and under 10 feet.....	2. 50
10 feet and under 13 feet.....	3. 50
13 feet and under 16 feet.....	4. 00
16 feet and under 20 feet.....	4. 50
20 feet or over.....	5. 00

If any vessel be boarded or spoken 20 miles eastward of Cape Henry, \$0.25 per foot shall be added to the foregoing rates.

All vessels coming into Hampton Roads seeking, in ballast, shall pay the same rate of pilotage as vessels calling for the sole purpose of coaling: *Provided, however*, That if such vessel coming to Hampton Roads, seeking, if afterward chartered to load in any port or place in this State, she shall pay the usual pilotage in and out as though she had come to a direct port. All steamers calling at any port or place in this State for the sole purpose of coaling shall pay \$1 less per foot than the regular rates under 10 feet, and all vessels drawing 10 feet and under 20 feet shall pay \$1.50 per foot less than regular rates; and all such vessels drawing 20 feet and over shall pay \$2 less per foot than the regular rates. All vessels having paid inward pilotage that go from Norfolk to Newport News or from Newport News to Norfolk, to load or finish loading, shall, if they take a pilot (which shall be optional with the master), pay a fee of \$10 to the pilot for transporting such vessel between said ports.

Vessels coming from sea to Hampton Roads and thence to any port in Maryland shall be subject to the same rate of pilotage as vessels bound from Newport News to sea.

The pilotage fee between Newport News and any point on James River is \$1.50 per foot, but pilotage is not compulsory.

Pilotage fees to and from Baltimore are as follows:

For every vessel of 15 feet or over draft, \$5 per foot; for every vessel of 12 feet and under 15 feet draft, \$4 per foot; for every vessel of less than 12 feet draft, \$3.50 per foot.

Any vessel bound from Baltimore to sea, subject to pilotage, and going into Hampton Roads for any cause except distress of weather, shall pay a fee of \$12 for inward pilotage and \$10 for outward pilotage in addition to the regular fee.

Towboats.—Towboats will sometimes be found cruising in the lower part of the bay near the entrance, and they will sometimes be found in the bay between the entrance and the mouth of Patapsco River. At Old Point Comfort tugs may be ordered by telegraph to Hampton Roads from Norfolk and Baltimore. Towboats from Baltimore seldom cruise below Sandy Point lighthouse unless previously notified.

Anchorage.—The following anchorages are the principal ones available for vessels bound up and down Chesapeake Bay: Lynnhaven Roads, just westward of Cape Henry, affords shelter against southerly winds in depths of 20 to 28 feet; Hampton Roads is a secure anchorage in all weather for vessels of any draft and is reached through a dredged channel 37½ feet deep; York River above Tue Marshes lighthouse affords good anchorage in 6 to 11 fathoms, protected from all but easterly winds; Mobjack Bay has secure anchorage westward of New Point Comfort in depths of 10 to 24 feet; Rappahannock River has anchorage within its mouth in depths of 8 to 10 fathoms; Great Wicomico River affords secure anchorage in

depths of 15 to 20 feet; anchorage secure from northerly winds can be had in depths of 15 to 30 feet in Cornfield Harbor inside of Point Lookout, and secure anchorage in any weather in St. Marys River, 5 miles northwestward; Patuxent River entrance affords secure anchorage for the largest ships, well sheltered and with good holding ground. There are several good anchorages on the eastern side of the bay, but they are seldom used by strangers.

Speed trial course.—A speed trial course 1 nautical mile long has been established on the western side of Kent Island, 5 miles northward of Bloody Point Bar lighthouse. The ranges are masts with white day marks. A line joining Bloody Point Bar and Sandy Point lighthouses leads at right angles to the ranges. Buoys have been established northward and southward of the course to mark the approach.

Supplies.—Baltimore, Norfolk, and Newport News are available as coaling ports for large vessels and have wharves equipped for rapid coaling. Water and ship-chandlers' supplies are obtainable at these places. As mentioned under the different headings, supplies can be obtained at many other places, but the quantity is apt to be limited and the facilities are not always good. Small vessels and motor boats bound up and down Chesapeake Bay and desiring supplies can best obtain them at Cape Charles, Reedville, Solomons Island, or Annapolis.

Repairs.—Repairs to the hulls and machinery of large vessels can be made at Baltimore, Newport News, and Norfolk. Places near Chesapeake Bay where repairs to small vessels can be made are Hampton, Salomons Island, Annapolis, and Crisfield. Further information is given under the different headings, and a table of largest dry docks and marine railways is given on page 5.

A list of storm warning display stations of the United States Weather Bureau is given on page 7.

Fog.—See page 5.

The reporting station for vessels entering Chesapeake Bay is at Cape Henry, from which vessels are reported to Norfolk and Baltimore either day or night, and with which vessels can communicate by use of the International Code by day or a flashing lamp and the Morse Code by night. Messages to or from vessels will be forwarded to destination. Vessels bound to Baltimore are also reported from Cove Point and Sparrows Point.

Quarantine.—Quarantine for all ports on Chesapeake Bay and tributaries, except Baltimore, is conducted by the United States Public Health Service. Vessels are boarded when off Old Point Comfort.

Vessels bound to Washington should preferably stop at the boarding station in Hampton Roads. Otherwise the boarding station is at Alexandria, where the facilities are not as good and some delay may be experienced.

Vessels bound to Baltimore are not required to stop at Hampton Roads, but are inspected at the quarantine station at Leading Point, Patapsco River, where the laws of the State of Maryland and the quarantine regulations of the city of Baltimore are in force; in general, the minimum requirements are in accordance with the United States Public Health Service.

Fish weirs are numerous in Chesapeake Bay and tributaries in season, the fishing season usually lasting from about March to July and from October to December, and many of them will be found in position throughout the year. They are thickest on the western side of the bay from Hampton Roads to Potomac River, but will be found throughout the bay and for a considerable distance above the entrances to the tributaries. Areas of possible fish traps should be avoided by small craft, especially at night, on account of the danger from stakes which may have been broken off and not removed.

Regulations governing the establishment of fish-net stakes in Chesapeake Bay and tributaries are prescribed by the Secretary of War. The general supervision of fishing structures is controlled by the Chief of Engineers, United States Army, Washington, D. C., from whom copies of the regulations and additional information may be obtained. Lines showing the limits of possible fish traps in Chesapeake Bay are shown on Coast and Geodetic Survey charts Nos. 77 and 78.

Fish stakes are prohibited within the regularly established or followed boat routes, such channels to have a width in the approach to the mouth of any tributary of not less than one-third the width of the mouth. In the tributaries they are prohibited at a greater distance from shore than one-third the distance across the stream from point to point in the wide portions, and from shore to shore elsewhere.

The outer end of each trap must have a bush or other suitable day mark, and a white light at night. When navigation is possible between the trap and shore, the inner end must have a red light at night. There must be a clear space of at least 200 feet between adjoining traps. Black and white horizontally striped buoys are established in many places in Chesapeake Bay and tributaries to mark the outer limits of possible fish traps.

Ice.—In severe winters ice forms in the head of the bay and in many of its tributaries. Under the influence of wind and tide ice will sometimes be met as far down the bay as Cove Point, very seldom below this. The weather shore is generally free from ice. Large steam vessels can always pass up and down the bay, but some of the tributaries may be closed to navigation for a period of a month or more during the winter. To vessels bound to and from Baltimore, ice sufficient to interfere with navigation of vessels is most often found in the vicinity of Seven Foot Knoll lighthouse, where ice packs are of frequent occurrence. The ice-breaker steamers from Baltimore attempt to keep the channel open, but navigation is sometimes blocked for limited periods, and none but the largest vessels enter or leave at night when ice may be expected.

In the tributaries north of Pocomoke Sound entrance on the eastern side and York River on the western side ice sufficient to interfere with navigation of small vessels and motor boats may be met with at any time between January 1 and April 1, and north of Patapsco River entrance ice is sometimes found a little before and after these dates.

The ice from Tangier and Pocomoke Sounds does not interfere with the larger vessels in the bay, but small vessels engaged in oystering and fishing are frequently held up by the ice, especially in

Kedges and Hooper Straits, and are forced to employ towboats to assist them.

Tides.—A table of tides is given on page 21. Further information is given under the different tributaries. Full tidal information is given in the tide tables for the Atlantic coast of the United States.

CURRENTS, CHESAPEAKE BAY.

The tidal currents in the bay and its tributaries are greatly influenced by the winds, which also affect the rise and fall of the tides to a marked extent, especially near the head of the bay. Strong northerly winds will increase the velocity of the ebb current and may, for a period, interrupt the flood current, while a strong southerly wind will increase the velocity of the flood current and may interrupt or retard the ebb current. Under normal conditions the velocity of the flood at strength is 1 knot at the Tail of the Horseshoe and 0.6 knot off Sandy Point, and the velocity of the ebb at strength is 1.5 knots at the Tail of the Horseshoe and 0.7 knot off Sandy Point. In the entrance of the bay and between the Middle Ground and the Tail of the Horseshoe and in the channels eastward of the Middle Ground the currents have a somewhat greater velocity, and under the influence of strong winds the shoals will sometimes be marked by rips. The effects of the flood and ebb currents are marked at the entrances of the principal tributaries, the effect being felt sometimes for a considerable distance from the entrances. Off the mouths of York, Rappahannock, and Potomac Rivers, especially the latter, a considerable set by ebb or flood currents is often experienced.

At Tail of the Horseshoe gas and bell buoy.—Slack water before the flood occurs about 5 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 2 hours 50 minutes before time of high water at Old Point Comfort), and slack water before the ebb about 5 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 2 hours 40 minutes after time of high water at Old Point Comfort). The mean velocity of the current at strength of flood is 1 knot, and at strength of ebb is 1.5 knots. These velocities are influenced to a considerable extent by winds. A westerly gale will at times cause a very strong ebb current and will greatly diminish the flood current, and an easterly gale will at times cause a very strong flood current and will greatly diminish the ebb current. The maximum strength of current against a strong gale may sometimes fall as low as 0.7 knot. During six months of observations in the summer and fall the greatest ebb current measured was 2.8 knots during a northwester, and the greatest flood current observed was 2.6 knots in an easterly gale.

At Middle Ground gas and whistle buoy No. 10.—Slack water before the flood occurs about 30 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 2 hours 40 minutes before the time of high water at Old Point Comfort), and slack water before the ebb occurs about 30 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 2 hours 40 minutes after time of high

water at Old Point Comfort). The mean velocity of the current at strength of flood is 1 knot and at strength of ebb is 1.5 knots.

Off Wolf Trap Lighthouse.—Slack water before the flood occurs about 1 hour 50 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 1 hour 30 minutes before time of high water at Old Point Comfort), and slack water before the ebb about 2 hours 25 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 1 hour 40 minutes before time of low water at Old Point Comfort). The mean velocity of the current at strength of flood (northerly) is 1 knot and at strength of ebb (southerly) is 1.5 knots.

Southeast of Windmill Point Lighthouse.—Off the mouth of the Rappahannock River a set to the eastward, due to an ebb current, and to the westward (to a less extent), due to a flood current, is often experienced.

Off Windmill Point.—The time of greatest strength of ebb current is about 45 minutes before the time when the current turns northwest at Chesapeake Bay entrance (or approximately 2 hours 30 minutes after time of low water at Old Point Comfort), and time of greatest strength of flood current is about the time when the current turns southeast at Chesapeake Bay entrance (or approximately 2 hours 15 minutes after time of high water at Old Point Comfort). Slack water before the flood occurs about 2 hours 30 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 40 minutes before the time of high water at Old Point Comfort), and slack water before the ebb occurs about 3 hours after the current turns southeast at Chesapeake Bay entrance (or approximately 40 minutes before time of low water at Old Point Comfort).

Off Smith Point Lighthouse.—Slack water before the flood occurs about 3 hours 15 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately at time of high water at Old Point Comfort), and slack water before the ebb occurs about 3 hours 15 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately at time of low water at Old Point Comfort).

Between Smith Point and Point Lookout.—A considerable set to the eastward due to an ebb current and to the westward due to a flood current is frequently experienced. The time of greatest strength of ebb current occurs about 45 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 3 hours after time of low water at Old Point Comfort or about 1 hour before time of high water at Baltimore). The time of greatest strength of flood occurs about 1 hour 15 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 3 hours after time of high water at Old Point Comfort or 1 hour 15 minutes before time of low water at Baltimore). The mean velocity of the current at strength of flood is 0.8 knot and at strength of ebb is 1 knot.

Off Point No Point.—Slack water before the flood occurs about 1 hour 15 minutes before the time when the current turns southeast at Chesapeake Bay entrance (or approximately 1 hour after time of high water at Old Point Comfort or about 3 hours before time of low water at Baltimore); slack water before the ebb occurs about

1 hour 40 minutes before the time when the current turns northwest at Chesapeake Bay entrance (or approximately 1 hour after time of low water at Old Point Comfort or 3 hours before time of high water at Baltimore).

Off Hooper Island Lighthouse.—Slack water before the flood occurs about 30 minutes before the time when the current turns southeast at Chesapeake Bay entrance (or approximately 2 hours 30 minutes before time of low water at Baltimore), and slack water before the ebb occurs about 1 hour 15 minutes before the time when the current turns northwest at Chesapeake Bay entrance (or approximately 2 hours 40 minutes before time of high water at Baltimore). The mean velocity at strength of current is 0.5 knot at flood and 0.6 knot at ebb.

Off Cove Point.—Slack water before the flood occurs about 20 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 1 hour 40 minutes before time of low water at Baltimore), and slack water before the ebb occurs about 25 minutes before the time when the current turns northwest at Chesapeake Bay entrance (or approximately 1 hour 40 minutes before time of high water at Baltimore). The mean velocity of current at strength of flood is 0.7 knot and at strength of ebb is 0.8 knot.

Off Sharps Island Lighthouse.—Slack water before the flood occurs about 1 hour 45 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 20 minutes before time of low water at Baltimore), and slack water before the ebb about 1 hour 15 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or about the time of high water at Baltimore).

Off Sandy Point Lighthouse.—Slack water before the flood occurs about 3 hours after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 1 hour after the time of low water at Baltimore), and slack water before the ebb occurs about 1 hour 50 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 30 minutes after the time of high water at Baltimore).

At Sandy Point.—The mean velocity of the current at strength of flood is 0.6 knot and at strength of ebb is 0.7 knot. Proceeding northward from Sandy Point, the strength of the current diminishes rapidly, being about 0.5 knot at Seven Foot Knoll and 0.3 knot at Fort McHenry at strength of flood or ebb.

At Fort McHenry.—Slack water before the flood occurs about 3 hours 30 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 15 minutes after the time of low water at Baltimore), and slack water before the ebb occurs about 2 hours 10 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 45 minutes after the time of high water at Baltimore). In Baltimore Harbor the currents are small.

Further current information for Chesapeake Bay is given in the **Current Tables** for the Atlantic coast of the United States. These tables include the predicted times of slack water for Chesapeake Bay entrance, current diagram of Chesapeake Bay with explanation and time differences for slack water for many places in Chesapeake Bay. They are for sale at 10 cents per copy from the sales agents.

GENERAL REMARKS, APPROACHES TO CHESAPEAKE BAY.

The prominent landmarks visible in approaching Chesapeake Bay entrance are described on page 102.

From northward.—General remarks and directions for the outside coast from New York to Chesapeake Bay are given on page 27. Currents for the outside coast are given on page 25.

From eastward.—The entrance may be approached boldly, as there are no outlying dangers. Twenty fathoms will be found about 45 miles eastward of Cape Henry; inside that depth the water shoals irregularly. In clear weather Cape Henry and Cape Charles light-houses and Cape Charles light vessel will be made about the same time at night, if standing westward near the parallel of 37° N. In thick weather safety may be insured by keeping in 10 fathoms. When in latitude 37° N. and 30 fathoms of water, a west (mag.) course will lead directly for Cape Henry lighthouse, but depths of $5\frac{1}{4}$ to 6 fathoms will be found from 5 to 14 miles eastward of the lighthouse, and deep-draft vessels in heavy weather should pass southward of these spots.

From southward.—Between Cape Henry and Cape Hatteras, a distance of about 105 miles, there are no dangerous outlying shoals over 5 miles from the beach; with the exception of a few places, 5 to 9 fathoms may be carried as close as 1 mile from the beach. Vessels of the deepest draft may, in smooth weather, run as close as 5 miles from the beach, but are not advised to do so, as it is a dangerous coast to be caught on in an easterly gale. The narrow stretch of sand beach forming the greater length of the coast is low and frequently may not be visible more than 4 or 5 miles. The 100-fathom curve, which, abreast of Cape Henry, is about 65 miles offshore, gradually approaches the coast southward and south-east of Cape Hatteras is only about 20 miles from the beach. The 30-fathom curve is about 5 miles inside of the 100-fathom curve. Abreast of Cape Henry 20 fathoms will be found about 45 miles off the coast, but farther southward that depth is found closer in, and at Cape Hatteras it is only 11 miles offshore. Inside of 15 fathoms the depths are extremely irregular, and there are many holes of limited extent lying far inside of the general limits of corresponding depth. In thick weather close attention should be paid to the soundings and the chart, and even then the navigator may be confused by the irregularities in depth.

DIRECTIONS, CHESAPEAKE BAY.

Directions for entering Hampton Roads are given on page 107, and for Patapsco River and Baltimore Harbor on page 184. Directions from the head of Chesapeake Bay to Norfolk for vessels following the inside route are given on page 238.

The least depth in the channel between Chesapeake Bay entrance and the entrance to the dredged channel leading to Baltimore is in the dredged channel eastward of York Spit, which is 35 feet deep and 1,000 feet wide. Between the entrance to the bay and this point the channel leads between Middle Ground Shoal and Tail of the Horseshoe and is well marked by buoys. Northward of York Spit the bay is clear in mid-channel, but shoals extend a long distance off

many of the points and islands. Strangers, unless in small boats, should keep outside the buoys and lighthouses marking the ends of the shoals.

The following table gives courses and distances from Chesapeake Bay entrance gas, whistling, and submarine bell buoy to the entrance of the dredged channel leading to Baltimore. They lead in a least depth of 35 feet, which is found in the new York Spit dredged channel. Between Tail of the Horseshoe gas and bell buoy and Wolf Trap lighthouse vessels of less than 20 feet draft often pass westward of York Spit Channel. Many deviations from these courses are possible for light-draft vessels, but for these the chart is the guide:

	Course.		Distance in nautical miles.
	True.	Magnetic.	
1. Chesapeake Bay entrance gas, whistling, and submarine bell buoy to 2 miles northeastward of Cape Henry lighthouse.	310	NW. $\frac{1}{8}$ N.....	8 $\frac{1}{4}$
2. To 1 mile southeastward of York Spit Channel entrance gas and whistling buoy. The course leads close eastward of Tail of the Horseshoe gas and bell buoy and $\frac{1}{2}$ mile or more westward of the red buoys marking the Middle Ground and $\frac{3}{4}$ mile westward of Middle Ground gas and whistling buoy No. 10.	324	NNW. $\frac{3}{4}$ W.....	14 $\frac{1}{4}$
3. To York Spit Channel lower entrance gas buoys..... The course leads eastward of York Spit Channel entrance gas and whistling buoy.	1	N. $\frac{1}{2}$ E.....	2 $\frac{1}{2}$
4. In York Spit Channel to north end.....	17	NNE.....	3 $\frac{1}{4}$
5. To 3 miles eastward of Wolf Trap lighthouse.....	2	N. $\frac{3}{4}$ E.....	9
6. To $\frac{3}{4}$ mile westward of Tangier Island Shoal Lump gas and bell buoy. The course leads 4 miles eastward of Windmill Point lighthouse.	354	N.....	23 $\frac{1}{4}$
7. To 1 mile eastward of Smith Point lighthouse.....	5	N. by E.....	6 $\frac{1}{2}$
8. To close westward of Sharps Island gas and bell buoy..... The course leads 1 $\frac{1}{2}$ miles eastward of Point No Point lighthouse, $1\frac{1}{4}$ miles eastward of Cedar Point lighthouse, $2\frac{3}{4}$ miles westward of Hooper Island lighthouse, and 1 mile eastward of Cove Point lighthouse.	343	N. $\frac{1}{8}$ W.....	42 $\frac{1}{2}$
9. To Poplar Island Shoal gas and bell buoy.....	357	N. $\frac{3}{8}$ E.....	12
10. To 1 mile eastward of Thomas Point Shoal lighthouse.....	6	N. by E. $\frac{1}{4}$ E.....	9
11. To $\frac{1}{2}$ mile eastward of Sandy Point lighthouse.....	15	N. by E. $\frac{1}{8}$ E.....	7 $\frac{1}{4}$
12. To gas and bell buoy at south end of Craighill Channel..... The course leads $\frac{3}{4}$ mile eastward of Baltimore lighthouse and westward of two red buoys.	343	N. $\frac{1}{8}$ W.....	3 $\frac{1}{4}$

Vessels desiring to pass westward of York Spit Channel can continue the 324° true (NNW. $\frac{3}{4}$ W. mag.) course for 1 mile up to York Spit Channel entrance gas and whistling buoy, then steer 8° true (N. by E. $\frac{1}{4}$ E. mag.) for 14 $\frac{1}{4}$ miles to a position 3 miles eastward of Wolf Trap lighthouse, and then follow the courses in the table.

CHESAPEAKE BAY ENTRANCE.

The entrance to Chesapeake Bay leading between Cape Charles on the north and Cape Henry on the south is about 10 miles wide; the main channel leads along the south side and is broad and deep. The northern half of the entrance is obstructed by shoals through which several minor channels lead.

The channel leading westward along the south side of **Nautilus Shoal** and northward along the west side of **Fisherman Island** and through either **North** or **Beach Channels**, is buoyed, had a least depth by the last survey of about 18 feet, and is used by fish steamers and tugboats up to 12 feet draft, but the shoals are subject to considerable change, and the channel is not recommended for strangers. **Nautilus Shoal** is moving rapidly southwestward. The general direction of movement of the shoals westward of **Nautilus Shoal** is southward, though the rate of movement is generally slow.

The most prominent landmarks in approaching the entrance to **Chesapeake Bay** are **Cape Charles lighthouse** and **Cape Charles old tower** on **Smith Island**, and a tank and several buildings on **Fisherman Island**, all on the north side; and **Cape Henry**, **Cape Henry lighthouse**, and **Cape Henry old tower** on the south side. **Cape Charles lighthouse** and old tower are described on page 79.

Cape Henry is a prominent bold range of sand hills 80 feet high, with lower ones near the water. On the beach near the point of the cape is **Cape Henry lighthouse**, and 340 feet southwestward of it is a white unused light tower; near the lighthouse are a storm-warning display station and a seacoast telegraph station of the **United States Weather Bureau**, from which vessels are reported to **Norfolk** and **Baltimore**, and with which they may communicate by the use of **International code signals** by day or the **Morse code** by night.

Cape Henry lighthouse is an octagonal pyramidal tower, upper and lower half of each face alternately black and white. The light is group flashing white (group of 3 flashes every 20 seconds), with a red sector between 155° true (S. by E. $\frac{3}{4}$ E. mag.) and 233° true (SW. by W. $\frac{1}{4}$ W. mag.), 157 feet above the water, and visible 19 miles. The fog signal is a siren, blast 4 seconds, silent 41 seconds. A radio fog signal transmits a series of 2 dots followed by a dash, for 20 seconds, silent 15 seconds, 1,000-meter wave length.

Tail of the Horseshoe gas and bell buoy, red and black horizontal stripes; the light is flashing white every 2 seconds, flash 0.5 second duration. The bell sounds continuously 1 stroke every 15 seconds.

Lynnhaven Roads, an open bight extending from 2 to 5 miles westward from **Cape Henry lighthouse**, is sometimes used as an anchorage and is protected from southerly winds. It has depths of 20 to 28 feet. The shoaling is abrupt eastward of **Lynnhaven Inlet**, and the 18-foot curve lies nowhere more than $\frac{3}{8}$ mile from shore. Westward of the inlet the shoaling is gradual, and depths of 18 feet can be found $\frac{3}{4}$ mile from shore.

Lynnhaven Inlet, on the south side of **Lynnhaven Roads**, forms the approach to **Lynnhaven Bay** and several other shoal bays. It had a depth by the last survey of $21\frac{1}{2}$ feet across the bar, but is subject to frequent change, and local knowledge is required to enter. A bridge with a draw opening 30 feet wide crosses the inlet just inside the entrance. The depths in the bays inside are 2 to 10 feet, and they are frequented by many small craft engaged in oystering and fishing.

HAMPTON ROADS AND NEWPORT NEWS.

Hampton Roads, at the south end of **Chesapeake Bay**, 16 miles westward of **Cape Henry**, is the approach to **Norfolk**, **Newport News**, and points on the **James River** to **Richmond**, and is also one of the

important anchorages on the east coast of the United States. A well-marked channel with a least depth of $37\frac{1}{2}$ feet leads into Hampton Roads, where there is secure anchorage for vessels of any draft.

Willoughby Bank is on the south side of the channel into Hampton Roads. From Fort Wool (Rip Raps) the shoalest part of the bank extends $2\frac{1}{2}$ miles east-northeastward and is marked off its northeast end by a gas and bell buoy and off the north side by a gas buoy. This part of the bank has been used as a dumping ground and has little depth over it. Just southward of Fort Wool is a narrow channel with a depth of 13 feet, which leads south of Willoughby Bank; it is little used except by boats engaged in dredging operations.

Willoughby Bay, formed by Willoughby Spit and the shoals extending northward from it and by Sewall Point, has depths of 8 to 12 feet in the outer part and 3 to 5 feet in the eastern end. The buildings of the naval base on the south side are prominent. There is a wharf on the western end of Willoughby Spit at which the ferry from Old Point Comfort lands, and there is an electric road from here to Ocean View and Norfolk. The entrance to the bay is $\frac{3}{8}$ mile west-southwestward of Fort Wool, has a depth of 7 feet, and is marked by a light and bell buoy on the west side and a black buoy on the east side. In entering leave the light 40 yards on the starboard side. There is a light on the western edge of the shoal, about midway between the entrance and the wharf at Willoughby Spit. A dredged channel, 15 feet deep and marked by buoys, leads along the north side of the naval base to the entrance to the lagoon. **Mason Creek**, on the south side of Willoughby Bay, is nearly bare at the entrance at low water and is little used. It is crossed by a drawbridge just inside the entrance. **Bush Creek** is reached through a dredged channel east of the naval base. It is used chiefly by small boats of the Navy.

Horseshoe is described under the heading "Hampton Roads to York River." **Thimble Shoal**, with depths of 9 to 11 feet, forms the south edge of the Horseshoe, and forms the north side of the channel into Hampton Roads between Thimble Shoal lighthouse and Old Point Comfort.

Old Point Comfort, on the north side, at the entrance to Hampton Roads, is a summer resort and the site of a military post (Fort Monroe). It has communication by railroad and electric road with Hampton and Newport News, with Norfolk by steamer, and with the west end of Willoughby Spit by ferry, from which an electric road runs to Ocean View and Norfolk. Most of the steamers plying from Norfolk to points on Chesapeake Bay and tributaries land at Old Point Comfort. Gasoline, provisions, and water in small quantities are obtainable. Landing at the wharf is often rendered difficult by the strong tidal currents. The first of the ebb tide sets southeastward from the wharf and the last of the ebb sets directly on the wharf and northward through the opening eastward of Hampton Bar. The direction of the flood current is approximately west-southwestward.

Mother Hawkins Hole is an anchorage, with depths of 9 to 12 feet, much used by small local craft, on the west side of Old Point Comfort and north of the easterly end of Hampton Bar. The entrance is between the wharf at Old Point Comfort and the horizontally

striped buoy close westward of it and has a depth of 18 feet. Leading northward from the west end of Old Point Comfort is a buoyed channel with depths of 7 to 20 feet, which affords good anchorage for boats.

Mill Creek, inside of Old Point Comfort, has large areas bare at low water and several narrow channels. It is crossed by two fixed bridges at the mouth, under which small boats can pass. The creek is little used.

Hampton Bar, with 2 to 5 feet over it, extends from 100 yards to 2 miles west-southwestward from Old Point Comfort; it is marked by red buoys on the south side and horizontally striped buoys at each end.

Hampton Creek, $1\frac{1}{4}$ miles west-northwestward of Old Point Comfort, is the approach to the town of **Hampton**. There is a depth of 9 feet across Hampton Flats from both eastward and southwestward to the entrance and the same depth in the channel in the creek. Steamers from Norfolk make regular trips to several wharves in the creek. It is the headquarters of a large number of boats engaged in oystering and fishing and has some trade in schooners and barges, the deepest draft being 10 feet. The part of the river between the public wharf and the lower bridge, a distance of $\frac{1}{4}$ mile, is used as an anchorage for boats. The river is crossed by several fixed bridges, and there is no navigation above them except in small motor boats without houses. Gasoline, provisions, coal, and water are obtainable, and there is a shipyard and railway capable of hauling out vessels of 125 tons, 125 feet length, 9 feet draft aft, and 6 feet forward.

Hampton Creek is usually approached from eastward, northward of Hampton Bar. Pass 300 yards southward and 175 yards westward of Hampton Creek light, off the entrance, and 150 feet westward of the red buoy near the entrance. Then head midway between the wharves at the entrance, pass in mid-channel eastward of a black buoy about $\frac{1}{4}$ mile above the entrance, and then follow the wharves on the west side at a distance of about 100 feet.

Newport News is an important seaport and has a trade in vessels up to $32\frac{1}{2}$ feet draft. It is the terminus of the Chesapeake & Ohio Railroad, which owns the wharves, grain elevator, and coal chutes at the southeast end of the city. It is also the site of the Newport News Ship Building & Dry Dock Co. plant, which has wharves at the northwest end of the city. There are sufficient depths at the shipyard and railroad piers for the largest vessels. Many steamers and small craft land at the Old Dominion Land Co. wharf. Gasoline, ice, and provisions may be obtained from this wharf. Just southward of this wharf is an inclosed basin for small boats about 150 yards square, having a depth of 7 feet in the entrance and 2 to 8 feet inside; it is privately owned but open to public use. The landing has begun to deteriorate, and the basin is not used as much as formerly.

A harbor for small craft and a municipal pier have been constructed by the city of Newport News in the mouth of **Newport News Creek**, $\frac{3}{4}$ mile southeastward of the most southerly coal pier. The harbor is 3,300 feet long and 300 feet wide. In 1922 there was a depth of 13 feet at the outer end of the pier, 9 feet at the entrance to the harbor, and 9 to 11 feet in mid-channel inside the harbor. The best water in approaching the entrance is from southwestward and leads close

along the western side of the pier in entering. Gasoline and yacht supplies may be obtained. A ferry leaves the municipal pier for Sewall Point, where electric cars make connection for Norfolk.

Channels.—The approach to Hampton Roads from eastward is through Thimble Shoal Channel, which has been dredged to a depth of $37\frac{1}{2}$ feet and width of 400 feet and is marked by red gas buoys on the north side and black (flashing white) gas buoys on the south side. The least depths outside of and near the dredged channel are 27 to 35 feet.

The following regulations prescribed by the Government restrict the use of this channel:

1. The use of Thimble Shoal Channel is hereby restricted to navigation by vessels of greater draft than 25 feet or by towboats with tows drawing more than 25 feet. Vessels, either sailing or power, and all tows drawing less than 25 feet are not permitted to use this channel.

2. Vessels permitted to use Thimble Shoal Channel under section 1 of these regulations must proceed through channel at a reasonable speed such as not to endanger other vessels and not to interfere with any work which may become necessary in maintaining, surveying, or buoying the channel; and they must not anchor in the channel, except in cases of emergency, such as fog or accident, which would render progress unsafe or impossible.

3. These regulations are not to be construed as prohibiting any necessary use of the channel by any Government boats while on Government duty, nor in emergencies by pilot boats, whether steam or sail, nor by police boats.

From the western end of Thimble Shoal Channel to the eastern end of Newport News Middle Ground the channel has ample width and depth and is marked by Thimble Shoal and Old Point Comfort light-houses and by several buoys, some of which are lighted.

Two channels have been dredged around Newport News Middle Ground to Newport News. The straight channel northward of the Middle Ground has been dredged to a depth of 35 feet and width of 600 feet. It is marked by red gas buoys (flashing white) on the north side and black gas buoys (occulting white) on the south side. The currents do not always set fair with the channel, especially with strong winds, and some trouble has been experienced at times by deep-draft vessels to keep in the channel. The least depths outside of and near the dredged channel are 21 to 24 feet.

The curved channel southward of Newport News Middle Ground was dredged to a depth of 30 feet and width of 500 feet, but shoaling has occurred and the channel will not be redredged. The area southward of the Middle Ground is now considered as anchorage grounds and the old channel is not marked.

Prominent objects.—In approaching Hampton Roads the most prominent objects are: **Thimble Shoal lighthouse** (red conical tower on pier); **Old Point Comfort lighthouse** (white tower); the buildings at Old Point Comfort; **Fort Wool**, a low gray structure on the south side of the entrance abreast Old Point Comfort; and a large group of buildings at **Ocean View**, a summer resort on the beach 4 miles southeastward of Old Point Comfort.

From inside the entrance some of the prominent objects are: A tower, the high dome of the **Soldiers' Home**, and several prominent chimneys at Hampton; a grain elevator at Newport News; **Newport News Middle Ground lighthouse** (brown conical tower on pier); the piers and buildings of the naval base; the **Virginian Railroad** coal piers, and a large grain elevator southward.

Anchorage.—Anchorage areas are prescribed by the War Department and are enforced by the captain of the Port of Hampton Roads (office at Norfolk). Anchorage limits are published in the Appendix, page 253.

Mother Hawkins Hole, inside of Hampton Bar and just west of Old Point Comfort, is much used by small craft of about 8 feet or less draft, and Hampton Creek is much used by motor boats in heavy weather.

Vessels of less than 7 feet draft can anchor in Willoughby Bay inside of Willoughby Spit, or they may anchor in 9 to 12 feet between Willoughby Spit and Sewall Point Spit, where they are sheltered from the sea by shoals with 2 to 5 feet over them.

The deep-water anchorage, with depths of over 6 fathoms, at **Newport News** in the entrance of James River is about $\frac{3}{8}$ mile wide along the wharves and to the dredged channels westward of Newport News Middle Ground; for a distance of $\frac{3}{8}$ mile farther from the wharves the depths are 21 to 36 feet.

Pilots for Hampton Roads, Newport News, and Norfolk will be found cruising off or in the entrance of Chesapeake Bay and can also be had at Old Point Comfort, where a Virginia pilot boat will usually be found. Pilotage is compulsory for certain vessels. (For further information see p. 93.)

Towboats can be had in Hampton Roads, or from Norfolk or Newport News, by telephone from Old Point Comfort.

Quarantine.—The boarding station for all vessels entering Hampton Roads is off Old Point Comfort. (See also p. 93.)

Storm warnings are displayed at Cape Henry, Old Point Comfort, Newport News, and Norfolk.

Repairs.—There are facilities for the construction and repair of the largest vessels. For the dimensions of the largest dry docks and marine railways at Newport News, Norfolk, Berkley, and Hampton see page 5.

Supplies of all kinds are obtainable at Newport News and Norfolk, and in limited quantities at Hampton and sometimes at Old Point Comfort. Water can be obtained at the wharves and from water-boats. Bituminous coal can be had, through chutes, from the coal wharves at Newport News and the coal piers at Sewall Point and Lambert Point. Anthracite and bituminous coal can be obtained at the wharves in Norfolk or from lighters at the anchorage. Water, provisions, and ship chandlery will be delivered by boat to vessels in Hampton Roads.

Regulations for passing dredges.—The following regulations apply to Norfolk; Hampton Roads; Nansemond, Pagan, and Appomattox Rivers; harbors at Cape Charles City, Va.; waterways from Norfolk Harbor, Va., to Albermarle Sound, N. C., via both Albemarle & Chesapeake and Dismal Swamp Canals; Edenton Bay; and Roanoke River, N. C.:

Vessels propelled by machinery and passing within $\frac{1}{4}$ mile of plant, employed in the improvement of said waters, shall not proceed at a speed greater than 4 miles per hour. In case it is necessary for any reason to pass said plant at a less distance than $\frac{1}{4}$ mile the propelling machinery of passing vessels must be stopped while said vessels are abreast of said plant. When it is necessary for a vessel to pass between any such plant and the buoys indicating the

position of the mooring anchors of said plant, such vessel shall give as a signal to said plant to lower the mooring lines four short blasts of a whistle or horn in quick succession, given when said vessel is about $\frac{1}{2}$ mile away from the plant. Vessels, when their draft permits, must go outside of the buoys indicating the position of the mooring anchors of all such plants.

No vessel shall anchor in such a place as to obstruct the view of the front or rear range or other marks erected for the guidance of any plant engaged in improving the above-mentioned waters. No vessel or raft shall pass over or so near to any buoys, piles, or other marks placed in connection with the above-mentioned improvements as to destroy, move, or injure them.

Tides.—The mean rise and fall of tides is 2.5 feet.

Currents.—In the center of the channel, about 2 miles southwest of Old Point Comfort, slack water before the flood occurs about 30 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 2 hours 30 minutes after time of low water at Old Point Comfort), and slack water before the ebb occurs about 30 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 1 hour 50 minutes after time of high water at Old Point Comfort). The mean velocity of the current at strength of flood is 1.5 knots and at strength of ebb is 1.7 knots; the currents, however, are influenced considerably by the wind and at times attain a velocity much in excess of these mean values. Along the wharves at Old Point Comfort the currents change about 1 hour earlier than in the center of the channel.

Ice seldom interferes with navigation in Hampton Roads for full-powered vessels, even in severe winters.

DIRECTIONS, HAMPTON ROADS AND NEWPORT NEWS.

1. From seaward.—From a position $13\frac{3}{8}$ miles north-northeastward of Cape Henry lighthouse a 287° true (WNW. mag.) course for 12 miles will lead through the middle of Thimble Shoal Channel and to a position $\frac{1}{2}$ mile southward of Thimble Shoal lighthouse. This channel is marked on its north side by red gas buoys (flashing red) and on its south side by black gas buoys (flashing white).

Pass about $\frac{1}{4}$ mile northward of Willoughby Spit gas and bell buoy and steer 262° true (W. $\frac{1}{4}$ S. mag.) for about 1 mile, heading for Old Point Comfort lighthouse. Then bring Thimble Shoal lighthouse astern on a 250° true (WSW. $\frac{3}{4}$ W. mag.) course. Pass well northward of a black gas buoy and enter Hampton Roads about midway between Old Point Comfort lighthouse and Fort Wool on a 235° true (SW. by W. $\frac{3}{4}$ W. mag.) course, heading for Newport News Middle Ground lighthouse, which will lead about 300 yards northwestward of Sewal Point Shoal gas and bell buoy. Anchor in accordance with anchorage regulations given on page 253. (See "Anchorages," preceding.)

1A. From northward, coming down Chesapeake Bay.—Vessels of the deepest draft should reverse the courses for passing up the bay and pass eastward and about $\frac{1}{4}$ mile southward of Tail of the Horseshoe

gas and bell buoy. A 265° true (W. mag.) course for 4 miles will then lead to the entrance of Thimble Shoal Channel between buoys Nos. 2 and 3.

There is a least depth of 31 feet on the Tail of the Horseshoe between the gas and bell buoy and the gas buoy lying $1\frac{1}{2}$ miles westward of it, and with a smooth sea vessels of a less draft can cross the shoal eastward of the buoy.

With a smooth sea a depth of not less than 19 feet can be carried between the Horseshoe and Tail of the Horseshoe by steering 173° true (S. mag.) from Middle Ground Shoal North End gas and whistling buoy to $\frac{1}{2}$ mile eastward of the 17-foot Lump gas and bell buoy. From this position a 228° true (SW. $\frac{7}{8}$ W. mag.) course for $1\frac{1}{2}$ miles will lead to buoy No. 2A and thence 263° true (W. mag.) to bell buoy No. 12. (See next paragraph.)

With a smooth sea a depth of not less than 19 feet can be carried across the end of Horseshoe Shoal on a line leading to bell buoy No. 12, lying $1\frac{1}{4}$ miles east-southeastward of Thimble Shoal lighthouse on a bearing of 190° true (S. by W. $\frac{3}{8}$ W. mag.) or anywhere eastward of this line; this course will also lead eastward of the limits of the fish traps on Horseshoe Shoal. From Middle Ground Shoal North End gas and whistling buoy a 180° true (S. $\frac{1}{2}$ W. mag.) course for $7\frac{1}{2}$ miles to abeam of Back River lighthouse will lead eastward of the broken ground with depths of 18 feet off the lighthouse; then a 215° true (SW. $\frac{3}{8}$ S. mag.) course will lead to bell buoy No. 12. From buoy No. 12 a 265° true (W. mag.) course will lead for Old Point Comfort lighthouse, passing 300 yards northward of Willoughby Spit gas and bell buoy.

Vessels crossing Horseshoe Shoal closer to Thimble Shoal lighthouse should keep that lighthouse bearing westward of 224° true (SW. $\frac{3}{8}$ W. mag.) in order to pass eastward of the limits of the fish traps; the least depth is 15 feet.

For courses used by local vessels of 7 feet or less draft crossing Horseshoe Shoal westward of Thimble Shoal lighthouse see Horseshoe Shoal, page 125.

2. Hampton Roads to Newport News—To pass through the dredged cut (35 feet) north of the Middle Ground.—Passing 300 yards northwestward of Sewall Point Shoal gas and bell buoy, bring Old Point Comfort lighthouse astern on a 224° true (SW. $\frac{3}{8}$ W. mag.) course for $1\frac{1}{2}$ miles until up with the buoys at the easterly entrance of the dredged cut. Steer 264° true (W. mag.) through the cut, which leads $\frac{5}{8}$ mile northward of Newport News Middle Ground lighthouse. The cut is marked on its north side by red gas buoys (flashing red) and on its south side by black gas buoys (occulting white). From the westerly end of the dredged cut steer about 307° true (NW. $\frac{1}{4}$ W. mag.) and pass 300 to 500 yards off the wharves at Newport News. Select anchorage $\frac{1}{4}$ to $\frac{3}{4}$ mile off the wharves according to draft. (See "Anchorages," preceding.)

ELIZABETH RIVER AND NORFOLK HARBOR.

Elizabeth River, emptying into Hampton Roads from southward, is important as the approach to the cities of Norfolk and Portsmouth, and the Dismal Swamp and Albemarle & Chesapeake Canals. Ves-

sels of 33 feet draft go to the coal piers inside the entrance, 32 feet draft to Norfolk, and 8 to 11 feet draft through the canals.

The main channel of Elizabeth River has been dredged to a depth of 40 feet and minimum width of 375 feet from Hampton Roads to the Belt Line Railroad bridge, just above the navy yard and $1\frac{3}{4}$ miles above the junction of the Eastern and Southern Branches. Considerable dredging has been done to a depth of 30 feet outside the limits of the 35-foot channel. The channel is well marked by buoys, some of them lighted, and by Craney Island lighthouse, and is easily followed.

Sewall Point, on the eastern side of the entrance to Elizabeth River, is the terminus of the Virginian Railway, and has two coal piers to which a channel 30 feet deep and 150 yards wide has been dredged. Vessels load here to a draft of 30 feet. It is connected with Norfolk by an electric road; and a ferry runs to the municipal pier, Newport News.

North of the coal pier is the Hampton Roads Naval Base, with piers and an inclosed basin affording protection for small naval vessels. There is 30 to 35 feet alongside the piers and 25 feet in the basin. South of the coal pier in order are the municipal grain elevator and pier, Standard Oil pier and Army base piers. Dredged channels, marked by buoys, lead from the main channel to these piers.

La Fayette River, formerly called **Tanner Creek**, on the east side of Elizabeth River, eastward of Craney Island lighthouse, has a depth of 5 feet in the entrance and 7 feet inside to the fork $3\frac{1}{2}$ miles above the entrance, above which there is a depth of 2 feet in either fork to near the head of navigation. It is frequented only by small boats. The channel at the entrance is marked by buoys, but is narrow and has extensive shoals on either side, and local knowledge is necessary to enter with the best water. There are no marks above the entrance, and some local knowledge is required to keep in the best water. The creek and its branches are crossed by several bridges; the first three in order from the entrance have draw openings 60, 40, and 28 feet wide, and those above are fixed.

Craney Island (low and sparsely wooded) is the site of a quarantine station of the cities of Norfolk and Portsmouth. There is a depth of $2\frac{1}{2}$ feet to the wharf on the southwest side. The shoal formerly extending eastward from the island has been bulkheaded and filled, and the southern end of the area is occupied by a large fuel oil depot. Pipe lines extend to wharves along the east face, at which there is 30 feet of water. Craney Island lighthouse (white house on piles) is off the northeast end of the filled area. A water pipe line crosses the channel off Craney Island. The crossing is marked by range lights and sign and vessels are cautioned not to anchor in the vicinity.

Lambert Point, on the eastern side of Elizabeth River, 1 mile southward of Craney Island lighthouse, is the site of the large coal and other piers of the Norfolk & Western Railroad. Depths of 30 to 33 feet are maintained by dredging alongside the wharves, and vessels load here to a draft of 33 feet. There are also piers belonging to the same company $\frac{3}{4}$ mile southeastward, at which depths of 28 to 30 feet have been dredged.

Western Branch, on the west side of Elizabeth River, southward of Lambert Point, has been improved by dredging a channel to a depth of 24 feet to abreast the wharves at West Norfolk below the first bridge. The width of the channel is 300 feet to within $\frac{1}{4}$ mile of the bridge and 200 feet to abreast the wharves. Some dredging has also been done to a depth of 16 feet on the point of the shoal on the north side at the entrance. The channel below the bridge is frequented by vessels up to 24 feet draft to a wharf at West Norfolk, and by towboats, car floats, and barges to the railroad wharves at Port Norfolk, the deepest draft being 14 feet. The channel is well marked, as shown on the chart.

For a distance of 3 miles above West Norfolk to the fourth bridge, Western Branch has a depth of 8 feet in a narrow unmarked channel. It is shoal in places above the fourth bridge, but is navigable for small boats for a further distance of about 3 miles. There is considerable traffic above West Norfolk in small vessels to farm landings. The chart is the only guide for strangers.

Six bridges cross Western Branch between the entrance and the head of navigation, and all have draw openings, the clear widths of which, in order from the entrance, are 65, 45, 50, 50, 25, and 24 feet.

West Norfolk, on the north side, at the entrance of Western Branch, is the site of a smelting plant to which ore vessels up to 24 feet draft go. The deeper draft vessels usually employ a towboat when entering. There is a shipyard and railway just above the bridge, which can take out vessels of 90 feet length and 10 feet draft.

Port Norfolk, on the south side, at the entrance of Western Branch, has a wharf and several ferry slips on the north side, at which car floats, towboats, and barges from the town of Cape Charles make landings. A depth of 15 feet can be taken to the wharves.

Pinner Point, on the southwest side of Elizabeth River, just above the entrance to Western Branch, is the main terminal of the Atlantic Coast Line and Southern Railroads, and has several wharves at which large vessels load and discharge.

Scott Creek, between Pinner Point and Hospital Point, has been improved by private enterprise and has a depth of 7 feet in a narrow channel for a distance of $\frac{1}{2}$ mile above the entrance to a drawbridge, above which it is shoal. It is used by vessels to the lumber wharves on the south side just below the bridge and by small boats to the oyster houses just above the bridge. The bridge has a center pier draw, each opening 35 feet wide, with a headroom of $4\frac{1}{2}$ feet at high water when closed.

Hospital Point is the site of a naval hospital. It is wooded, and a black water tank and the dome of the main hospital building are visible above the trees.

Smith Creek, opposite Hospital Point, has a depth of 8 feet in the entrance and 6 to 7 feet inside to several wharves on its west and south sides. It is frequented by towboats, barges, and car floats, carrying coal and building material to the yards inside, and its northern arm is used as an anchorage by motor boats. It is crossed by a drawbridge.

Norfolk, on the east bank of Elizabeth River, 7 miles above Sewall Point, is one of the important ports of the United States for the shipment of coal, cotton, and merchandise; it has a large foreign and coasting trade and is a terminus of several railroads. Several

lines of coasting and bay steamers ply from the port, and it is the center of steamboat traffic to Cape Charles City and to the tributaries on the west side of the bay as far as Rappahannock River. It has ferry communication with Portsmouth and Berkley and frequent communication by steamers with Newport News, Old Point Comfort, and Hampton.

Public docks.—There are two public docks on the Norfolk water front used by small local craft. One is eastward from Hospital Point and at the head of the slip on the north side of the Merchants & Miners' Transportation Co. wharf; there is also a small boat landing at the head of the slip on the south side of this wharf, at which landings can be made with permission of the agent. The other public dock is a slip of 100 yards long lying 80 yards westward of the ferry slips.

Berkley, a part of the city of Norfolk, is on the point between Eastern and Southern Branches. The main freight terminus of the Norfolk Southern Railroad, and several lumber and fertilizer wharves are located here, and there are also several shipyards and marine railways.

Portsmouth, on the west side of Elizabeth River, opposite Norfolk and Berkley, is the site of a United States navy yard and is the main terminus of the Seaboard Air Line Railroad. It has several other commercial wharves and has considerable trade in foreign and coast-wise vessels.

Eastern Branch, extending eastward along the south side of the city of Norfolk, has been improved by dredging a channel with a depth of 25 feet to the second bridge, $\frac{7}{8}$ mile above the entrance, and 22 feet a farther distance of $\frac{1}{2}$ mile to the third bridge. The branch above this point has a natural channel with a depth of 16 feet to the fourth bridge, $2\frac{1}{2}$ miles above the entrance, and 10 feet to the fork, $3\frac{1}{2}$ miles above the entrance.

The north fork (**Broad Creek**) has a depth of 2 feet for $1\frac{3}{8}$ miles, and the south fork a depth of 2 feet for about 2 miles. Below the third bridge there is an extensive traffic to the wharves at Norfolk and Berkley, but above that point the branch is little used except by small local craft.

From the entrance to the second bridge the entire channel of Eastern Branch is clear, with a depth of 18 feet or more, if the ends of the wharves on the Berkley side be given a berth of 70 yards. The width, with a depth of 25 feet, is about 100 feet, and the best water leads along the north side. Between the second and third bridges the channel favors the north side, a straight course between the draws of the second and third bridges leading in the middle of the dredged channel. From the third bridge the channel favors the north side for $\frac{1}{2}$ mile, and then leads for the draw of the fourth bridge. From the fourth bridge the best water trends eastward for 400 yards, and then about 74° true (E. by N. mag.) for $\frac{5}{8}$ mile to the fork. It is easily followed to this point with the aid of chart 451.

Four drawbridges cross Eastern Branch between the entrance and the fork. The new Berkley bridge, $\frac{5}{8}$ mile above the entrance, is a double-leaf bascule draw, with a clear opening of 140 feet, and a headroom of 32 feet at high water when closed. The Norfolk & Western Railroad bridge, $\frac{7}{8}$ mile above the entrance, has a lift opening 140 feet wide and a headroom of 7 feet at high water when

closed. The Campostella Bridge, $1\frac{3}{8}$ miles above the entrance, has a swing truss draw with two clear openings 135 feet wide and a headroom of 4 feet at high water when closed. The Virginian Railway bridge, $2\frac{1}{2}$ miles above the entrance, has a center pier draw, each opening 60 feet wide, with a headroom of 6 feet at high water when closed. The ebb current through the latter bridge has a southerly set. Three bridges cross the north fork (Broad Creek). The first two, just above the fork, have draw openings about 30 feet wide, and the third, $1\frac{1}{8}$ miles above the fork, has a draw opening 28 feet wide, but there is little navigation above.

Indian River, on the south side of Eastern Branch, $2\frac{1}{2}$ miles above the entrance, has a depth of 3 feet for $\frac{3}{4}$ mile above the mouth.

Southern Branch of Elizabeth River (chart 451) forms the southern approach to the two canals which afford passages from Chesapeake Bay to the inland waters of North Carolina. This branch is of considerable commercial importance; there are several large lumber mills and other manufactories at which vessels load, and the commerce using the canals also passes through the branch. The inside route through the canals is described in United States Coast Pilot, section D, Cape Henry to Key West; and Inside Route Pilot, New York to Key West.

Between the first and second bridges the channel of Southern Branch has been dredged 300 feet wide and 25 feet deep, and between the second and third bridges 200 feet wide and 22 feet deep; above this and to the lock of the Albemarle & Chesapeake Canal the channel has been dredged to 12 feet, with cut-offs of the same depth to avoid some of the worst bends. The channel for its whole length of $10\frac{1}{2}$ miles is marked by buoys and is not difficult to navigate as far as the entrance to Deep Creek with the aid of the chart. Above this, to the lock of the Albemarle & Chesapeake Canal, some local knowledge is needed to follow the channel.

Bridges, Southern Branch.—The whistle signal for all bridges across Southern Branch is three long blasts.

Belt Line Railroad bridge, $1\frac{3}{4}$ miles above the entrance, has a center pier draw, each opening 110 feet wide, with a headroom of 15 feet at high water when closed.

Virginian Railway bridge, $2\frac{3}{4}$ miles above the entrance, has a center pier draw, each opening 110 feet wide, with a headroom of about 7 feet at high water when closed.

Norfolk & Western Railroad bridge, 5 miles above the entrance, has a single lift opening 125 feet wide, and a headroom of 7 feet at high water when closed.

The railroad bridge across Southern Branch, $\frac{3}{4}$ mile above the mouth of Deep Creek, has a center pier draw, each opening 80 feet wide, with a headroom of $7\frac{1}{2}$ feet at high water when closed.

The highway bridge $\frac{3}{4}$ mile farther up has a center pier draw, each opening 80 feet wide, with a headroom of about 6 feet at high water when closed.

The Albemarle & Chesapeake Canal route has been purchased by the Government and is free of tolls. This canal connects the Southern Branch of Elizabeth River with **North Landing River**, and is entered about $10\frac{1}{2}$ miles from Norfolk. The canal is $7\frac{1}{4}$ miles long and had a controlling depth of 9.6 feet in 1923. It is crossed by four drawbridges. The depth of water in the canal is lowered by north-

erly winds and raised by southerly winds; severe storms may cause a difference of 2 feet or more below or above the normal.

Deep Creek, which empties into Southern Branch about 6 miles above Norfolk, is $2\frac{1}{2}$ miles long to the entrance of the Dismal Swamp Canal. The creek has been improved by dredging a channel 100 feet wide and 10 feet deep from the Southern Branch to the canal. On the south side at the entrance of the creek there is a signboard directing the way to the Dismal Swamp Canal.

Dismal Swamp Canal (Lake Drummond Canal & Water Co.'s canal) connects Deep Creek with the Pasquotank River. The northern lock of the canal is about $8\frac{1}{2}$ miles above Norfolk. This canal is about 19 miles long, 60 feet wide, and 9 to 10 feet deep, with turnouts at distances of about 3 miles where vessels may pass each other; the two locks are 250 feet long and 39 feet wide.

Anchorage, Elizabeth River.—Anchorage in Elizabeth River is along the sides of the dredged channel, is limited in area, and is frequently congested. The usual and best anchorage for deep draft vessels is on the west side of the channel opposite Lambert Point, between Craney Island lighthouse and the entrance of Western Branch, in depths of 24 to 36 feet. The generally used anchorage near Norfolk for small vessels and barges are on the west side of the channel between Hospital Point and the lower wharves at Portsmouth, on the east side of the channel at the mouth of Smith Creek, and on the south side of the channel in Eastern Branch between Norfolk and Berkley.

For general information for Elizabeth River relating to pilots, tow-boats, supplies, repairs, storm warnings, and dredge regulations, see "Hampton Roads."

Quarantine for the district of Elizabeth River is under the control of the United States Public Health Service and the boarding station is at Old Point Comfort.

Harbor regulations.—The captain of the port of Hampton Roads (office, Customhouse, Norfolk) has control of the berthing of vessels and designates the anchorage grounds. Vessels are not permitted to anchor in the dredged channels. The limits of speed for vessels above Sewall Point are, for vessels under 100 tons, 10 statute miles per hour; 100 to 1,500 tons, 9 miles; over 1,500 tons, 8 miles.

A **United States Branch Hydrographic Office** is located at the customhouse. Bulletins are posted here giving information of value to seamen, who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service. A time ball is dropped at noon, seventy-fifth meridian time, and is visible from anywhere in the harbor.

Ice.—The harbor is generally free of ice and navigation is never obstructed for full-powered vessels. In severe winters the upper part of Southern Branch is sometimes closed for short periods.

Tides.—The mean rise and fall of the tides is 2.6 feet at Craney Island and 2.8 feet at the navy yard.

Currents.—In the Southern Branch of the Elizabeth River, opposite the navy yard, the tidal currents change at about the times of high water and low water at the navy yard or slack water before the flood occurs about 2 hours after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 45 minutes after

time of low water at Old Point Comfort); and slack water before the ebb occurs about two hours after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 30 minutes after time of high water at Old Point Comfort). The mean velocity of the currents at strength is about 1 knot.

Directions, Elizabeth River.—There are no natural ranges for the 40-foot dredged channel, and some local knowledge is required for vessels of the deepest draft to follow the best water. Range beacons mark the center line of the channel, but at times they are hard to see on account of hazy weather. Otherwise the channel is well marked and easily followed in clear weather, although the channel is often crowded with traffic. Shoals rise abruptly in places on the sides of the channel, as shown on the chart. A towboat is generally used by large vessels when docking. The following are the courses through the dredged channels:

Passing about 200 yards westward of Sewall Point Shoal gas and bell buoy, steer 184° true (S. $\frac{7}{8}$ W. mag.) for $3\frac{1}{2}$ miles, being guided by the buoys, some lighted, which mark the sides of the channel, until up with Bush Bluff gas and bell buoy. A set of ranges are in line ahead on this course. They show between the two eastern rows of oil tanks on the Craney Island fill. Pass westward of the gas and bell buoy and steer 172° true (S. $\frac{1}{4}$ E. mag.), being guided by the buoys, and passing about 200 yards eastward of Craney Island lighthouse and about 150 yards westward of the northerly piers at Lambert Point. A set of range beacons are in line ahead on this course. From a position 300 yards off the southerly piers at Lambert Point the course is 131° true (SE. $\frac{1}{8}$ S. mag.) for the ends of the wharves at Norfolk; a set of range beacons are in line astern on this course. (For anchorage areas see Appendix, p. 253.)

NANSEMOND RIVER,

on the southwest side of Hampton Roads, between Big Point and Barrel Point, and 2 miles southwestward of Newport News Middle Ground lighthouse, is the approach to the city of Suffolk, 18 miles above the mouth. Big Point has a prominent long wharf, and there is an Army supply base here. The river has considerable trade in small produce boats and a few barges and schooners, the deepest draft being 10 feet; this draft can be taken to Suffolk at high water. There are several wharves below Suffolk from which farm produce is shipped. The channel has been improved by dredging to a depth of 12 feet and width of 80 feet from the mouth to Suffolk, but had shoaled to a controlling depth of $9\frac{1}{2}$ feet in 1922. Small boats can go several miles above Suffolk. (For regulations for passing dredges, see p. 106.)

From the entrance to the mouth of Western Branch, 6 miles below Suffolk, the river is wide, but the channel is crooked and leads between extensive shoals which are nearly bare in places at low water. Above this point the river is narrow and crooked, but the mid-channel is clear to Suffolk. The channel is marked by buoys and several lights as far as Western Branch. There is a dike on the eastern side of the channel opposite the mouth of Western Branch; the northern end is submerged at extreme high water and unmarked. Strangers up to 6 feet draft should have no trouble in following the

channel to Suffolk with the aid of the chart. Those of deeper draft are advised to take a pilot. One can usually be obtained near the mouth of the river or at Norfolk or Newport News.

Bennett Creek, on the south side of Nansemond River, $2\frac{3}{4}$ miles above Nansemond River lighthouse, has a depth of about 3 feet on the bar at the entrance and 6 feet inside for 5 miles above the entrance to the A. C. L. bridge. It is frequented by produce and pleasure boats, the deepest draft being 4 feet. A staked channel carries 3 feet over the bar into the creek. To enter, leave the stakes on the port hand.

Western Branch, on the west side of Nansemond River, 6 miles below Suffolk, is said to have a depth of 5 feet at high water for 5 miles above the mouth and is used by a few small produce and wood boats.

Suffolk, a city at the head of navigation for vessels on Nansemond River, 18 miles above the mouth, is an important railroad center. Gasoline and provisions are obtainable, and there is water on the wharves. A drawbridge having a draw opening 34 feet wide crosses the river at the upper end of the wharves, and there is little traffic above.

Tides.—The mean rise and fall of tides is 2.6 feet at the entrance and 3.4 feet at Suffolk.

JAMES RIVER,

emptying into the western end of Hampton Roads at Newport News, is the approach to the cities of Richmond and Petersburg and the towns of Smithfield and City Point. It is navigable to the city of Richmond, 89 miles above Newport News. The river has a large trade in coal, oil, farm and wood products, and general merchandise carried in barges, schooners, and the regular steamers. The deepest draft going to Richmond is 16 feet and the usual draft not over 13 feet.

Channel.—James River is being improved under a project to obtain a depth of 22 feet from the mouth to Richmond. The project width is 400 feet from the entrance to City Point, 60 miles above Newport News, 300 feet to Drury Bluff, $6\frac{1}{2}$ miles below Richmond, and 200 feet to Richmond, widened to 400 feet abreast the wharves at Richmond to form a turning basin. In 1923 there was a channel 17 feet deep from the entrance to Richmond; this depth exists at Goose Hill Flats.

There are numerous wharves along the main channel of James River, many of them with a store and post office but no settlement near them. They are used as shipping and receiving points for farm and wood products and supplies for the surrounding country. Regular steamers between Norfolk and Richmond make stops at most of them, and there is regular freight service to New York.

The small creeks tributary to James River are usually shoal at the entrances with deeper water inside for long distances. Most of them are frequented by small produce boats and by barges and small sail vessels carrying wood and lumber. Local knowledge is generally necessary to keep in the best water.

Chuckatuck Creek, 4 miles southwestward of Newport News, has a depth of $3\frac{1}{2}$ feet across the bar at the entrance and deeper water inside to the village of Crittenden, just above the entrance. There is

a depth of 3 feet to the village of **Chuckatuck**, 5 miles above the entrance. There is a shipyard and railway at **Crittenden** capable of hauling out any of the boats navigating the creek. The channel in the approach leads northward and westward of the light in the entrance of **Ragged Island Creek**, then southward of the red buoy in the entrance of **Chuckatuck Creek**.

Ragged Island Creek, just northward of **Chuckatuck Creek**, is shoal and little used. Small boats can go to near the head at high water only.

White Shoal, a middle ground 5 miles northwestward of **Newport News**, is marked by **White Shoal lighthouse** (white hexagonal house on piles). There are channels on either side, but the buoyed channel with a depth of 17 feet southward of the lighthouse is generally used.

Pagan Creek, on the southwest side of **James River**, southwestward of **White Shoal lighthouse**, has been improved by dredging a channel 10 feet deep and 40 feet wide to the town of **Smithfield**, 5 miles above the entrance, but is subject to some shoaling. The deepest draft entering is 10 feet at high water, and usual draft not over 8 feet. There is a black bell buoy on the southwest side of the main channel of **James River**, in line with the entrance cut of **Pagan Creek**. The channel is also marked by a buoy and several lights. Navigation by vessels is rendered difficult on account of the narrow channel and the sharp turns, and strangers should take a pilot; one can be obtained at **Newport News** or **Battery Park**. (For regulations for passing dredges see p. 106.) The mean rise and fall of tides is 2.5 feet.

Jones Creek, on the south side of **Pagan Creek**, just inside the entrance, has a depth of 3 feet across the flats at the entrance and deeper water inside for $3\frac{1}{2}$ miles. It is crossed by two drawbridges, having a least width of 25 feet; the first is near the mouth and the second $2\frac{1}{2}$ miles above.

Battery Park is a post village on the south side of **Pagan Creek**, just inside the entrance. There are marine railways here, the largest capable of hauling out boats of 50 tons, 60 feet length, and 8 feet draft.

Cypress Creek, a tributary of **Pagan Creek** from southward just below **Smithfield**, has a depth of 4 feet for about 3 miles above the mouth. A highway bridge with a single clear opening 30 feet wide crosses the creek at the entrance.

Smithfield, a town at the head of steamboat navigation on **Pagan Creek**, is connected with **Newport News** and **Norfolk** by steamer. There are depths of 10 feet at the wharves. Gasoline, provisions, and water are obtainable. A highway bridge having a draw opening 24 feet wide crosses the creek just above the wharves at **Smithfield**. **Pagan Creek** is navigable for small boats for 3 miles above the bridge, but is little used.

Warwick River, on the north side of **James River**, 7 miles above **Newport News**, has a depth of 6 feet in a narrow unmarked channel for 2 miles above the entrance, $2\frac{1}{2}$ feet for the next $\frac{3}{4}$ mile, and deeper water for a farther distance of 3 miles or more. The entrance is used as an anchorage by small oyster and fishing boats. The deepest draft entering is about 5 feet. There are unmarked shoals with depths of 3 to 5 feet off the entrance. A 351° true (N. $\frac{3}{8}$ W.

mag.) course, with White Shoal Lighthouse astern, will lead to the entrance.

Point of Shoals is an extensive shoal area in mid-river 10 miles above Newport News, and there are extensive unmarked shoals extending to the shore northeastward. The main shoal is marked by **Point of Shoals lighthouse** on the western end. Small local boats pass north-eastward of the shoal through Mulberry Island Channel, marked by buoys, but strangers should follow the main channel southward and westward of it.

Fergussons Wharf (Rushmere post office) is on the western side of James River westward of Point of Shoals lighthouse.

Lawns Creek, $1\frac{3}{4}$ miles westward of Deep Water Shoals lighthouse, has a depth of about 3 feet across the bar, and this depth can be carried for 4 miles above the entrance. The deepest draft entering is about 5 feet. A prominent long wharf, now in bad condition, $\frac{3}{8}$ mile southward of Deep Water Shoals lighthouse is the landing for Camp Eustis.

Skiff Creek, 2 miles northeastward of Deep Water Shoals lighthouse, has a depth of 2 feet across the flats at the mouth and deeper water inside for about 3 miles. It is little used.

Hog Point, 23 miles above Newport News, is low, with scattered clumps of trees. Homewood Wharf and post office are on the east side of the point.

College Creek, on the north side of James River, northward of Hog Point, has a depth of 2 feet across the flats at the mouth, 6 feet inside for 2 miles, and $2\frac{1}{2}$ feet for a farther distance of $\frac{1}{2}$ mile to **Williamsburg Landing**, 1 mile from the town of **Williamsburg**. The channel is difficult without local knowledge.

Jamestown Island is on the north side of James River, 27 miles above Newport News. **Jamestown** is a landing, and a post office is on the western end. A white monument and the wharf are the most prominent marks. **The Thoroughfare** and **Back River**, northward of Jamestown Island, have a depth of about 2 feet at the eastern and western ends and 7 to 20 feet in the narrow channel northward of the western end of the island. They are used to some extent as an anchorage for small boats, but through navigation is prevented by a fixed bridge, under which only small boats without houses can pass.

Cobham Wharf is a landing on the south side of James River, southward of Jamestown Island and $\frac{3}{8}$ mile westward of Goose Hill Channel range lights. One mile northwestward is **Scotland Wharf** and post office, from which there is railroad communication with the Norfolk & Western Railroad at **Wakefield**. A large amount of lumber and wood is shipped in schooners and barges. Just westward of Scotland is **Greys Creek**, which has a depth of 3 feet across the flats at the entrance and deeper water inside for about 4 miles.

Chickahominy River (chart 530) is on the north side of James River, 33 miles above Newport News and 5 miles above Jamestown Island. It has been improved by dredging a channel 14 feet deep across the bar at the entrance and 8 feet deep to Windsor Shades, but the project is abandoned and the channels have shoaled. By the last survey there was a depth of about 11 feet at the entrance, 10 feet to **Binns Bar**, 20 miles above the entrance, and 6 to 7 feet for a farther distance of

2 miles to **Windsor Shades**. Small boats can go several miles farther, but navigation is difficult. The principal trade in the river is in wood and lumber, carried in barges and an occasional schooner. The deepest draft loaded in the river at or below Windsor Shades is about 9 feet.

The channel of Chickahominy River is crooked, narrow, and obstructed by shoals, and local knowledge is necessary to keep in the best water. Towboats are always employed and are usually obtained from Norfolk. The best water in the approach leads along the north shore from Jamestown Landing to the buoys at the mouth. The mean rise and fall of tides is 1.9 feet at the mouth and 2.4 feet at Windsor Shades. Chickahominy River has several narrow tributaries with a good depth of water for several miles. **Gordons, Morris, and Yarmouth Creeks** are the ones most often entered by barges and schooners.

Lanexa is a post office and railroad station on Chickahominy River, 15 miles above the entrance.

Claremont is a village and railroad station on the south side of James River, 38 miles above Newport News. There are several wharves, with depths of 7 to 15 feet, from which forest products are shipped in barges and schooners. Gasoline and provisions are obtainable. On the north side of the river, opposite Claremont, is **Sandy Point Landing** (Tettington post office).

Chippoak Creek is on the south side of James River, $1\frac{1}{2}$ miles westward of Claremont. It has a depth of about 5 feet for 4 miles and 2 feet to near the head of navigation. The deepest draft entering is 7 feet. A pilot can be obtained at Claremont. The best water in the entrance leads close along the south side. There are two wharves with warehouses on the south side at the entrance.

Between Chippoak Creek and the bend, $3\frac{1}{2}$ miles northward, are **Brandon Wharf** and post office and **Ritchie Wharf** (store) on the west side and **Oldfield Wharf** on the east side. On the north side of James River, opposite Kennon Marsh, are two wharves. There is a brickyard at the upper wharf. On the south side of the river, southwestward of Kennon Marsh, is Upper Brandon wharf and two wharves in ruins. **Kittewan Creek**, on the north side, $1\frac{1}{4}$ miles westward of Kennon Marsh, is nearly bare at the mouth at low water and has deeper water inside.

Ward Creek, on the south side, $\frac{3}{4}$ mile southeastward of Weyanoke Point, has a depth of 1 to 2 feet across the flats at the mouth and deeper water inside for 3 miles. The ruins of a pier, submerged at extreme high water, are on the edge of the main channel at the entrance of the creek. A lumber wharf is westward of Wards Creek. A light on Fort Powhatan wharf marks the narrowest part of the channel here.

Weyanoke Wharf and post office are on the east bank of the river, 1 mile above the bend at Weyanoke Point.

Wilcox Wharf and post office are on the north bank of James River, northward of Windmill Point.

Herring Creek, on the north side, 2 miles westward of Windmill Point, has a depth of 2 feet across the flats at the entrance and is used by boats of 4 feet draft at high water. A wharf and prominent water tank lie $\frac{1}{2}$ mile westward of the creek, and $\frac{3}{4}$ mile farther

westward are **Westover Wharf** and post office. On the south side, opposite the entrance to the creek, are **Blairs Wharf** and post office.

Powells Creek, just eastward of Coggins Point, has a depth of 4 feet for 3 miles above the entrance and is entered by boats of 6 feet draft at high water.

City Point is a town at the junction of James and Appomattox Rivers, 60 miles above Newport News, and is the terminus of a branch railroad line to Hopewell and Petersburg. There are depths of 15 to 20 feet at the wharves. Gasoline and provisions are obtainable. Pilots for the upper part of James River and Appomattox River can be obtained here, and towboats may be ordered by telephone or telegraph.

Hopewell, a short distance inland from City Point, is the site of a large powder factory.

Appomattox River, on the west side of James River, 61 miles above Newport News and 28 miles below Richmond, is navigable for vessels to the head of navigation at Petersburg, 10 miles above the mouth. The river has been improved by dredging and the construction of training walls to obtain a channel 80 feet wide and 9 feet deep to Petersburg and had a controlling depth of 8 feet in 1922. It is frequented by passenger steamers and a few barges and schooners, the deepest draft being $8\frac{1}{2}$ feet. There are no wharves between Petersburg and the mouth. The most difficult part of the channel, through the flats at the mouth and from Point of Rocks to a point about 1 mile above, are marked by buoys, and for the remainder of the river a general mid-channel course is the best, although unmarked shoals extend nearly to mid-channel in places. Strangers should have no trouble in taking a draft of about 6 feet to Petersburg with the aid of chart 531. A pilot can be obtained at City Point. The depth at the entrance is about 12 feet, and the best water lies about 75 yards south of the light. (For regulations for passing dredges see page 106.) The mean range of tides is about 2.8 feet.

The **northern branch of Appomattox River**, entering the main channel at **Point of Rocks**, has a depth of 7 feet at the entrance. There is a farm landing $\frac{3}{4}$ mile above the entrance, at which barges are sometimes loaded. The best water in entering leads 100 feet off Point of Rocks.

Petersburg has communication by railroad and by steamboat with City Point and points on the James River to Richmond. All kinds of supplies are obtainable. Ice and freshets do not interfere with navigation. The wharves have available depths of 5 to 6 feet. A railroad siding, extending for almost the entire length of the wharf front, furnishes a means of transfer between the wharves and the railroads.

Bermuda Hundred is a post office on the west bank of James River, $1\frac{1}{2}$ miles above City Point. The wharf has depths of 5 to 9 feet. A fixed white light is shown from the outer end. Opposite Bermuda Hundred is **Shirley Wharf** and post office. **Hardens Wharf**, on the east bank, $2\frac{1}{4}$ miles above Bermuda Hundred, is a lumber-shipping point. There are several farm wharves between Hardens Wharf and Richmond but no villages. The shores are generally wooded on both sides and present no characteristic features.

Curles Swamp Creek, on the west side, 6 miles above City Point, has a depth of 1 foot at the entrance and deeper water inside.

Richmond, at the head of navigation on James River, has considerable trade in the regular steamers and barges and schooners, the deepest draft being 16 feet and usual draft not over 13 feet. It is connected with Norfolk and intermediate landings and New York by steamers. There are depths of 10 to 15 feet at the wharves on the northeast side of the river.

Manchester is a town on the south side of the river, opposite Richmond, with which it is connected by several bridges.

Richmond City Dock, having its entrance at the upper end of the wharves on the northeast side of the river, is an inclosed basin a little over $\frac{1}{2}$ mile long and 75 to 150 feet wide. It is entered through a lock 180 feet long and $33\frac{1}{2}$ feet wide, with a depth of 14 feet on the sill. The depth is 10 feet in the approach to the lock and 15 feet in mid-channel inside, and it can be entered by vessels of 13 feet draft at high water. A railroad bridge with a draw opening 50 feet wide crosses the dock just above the entrance lock. The dock is extensively used for the loading and discharge of small vessels and is a secure harbor during freshets. Lockage is charged.

A public wharf with a depth of 15 feet alongside extends about 700 feet downstream from Gilliss Creek, on the east side, $\frac{1}{4}$ mile below the entrance to the lock and $\frac{1}{8}$ miles below the steamboat wharf.

Freshets occur irregularly in the fall, winter, and spring, their height at Richmond ranging from 4 to 28 feet, though the latter is exceptional. The maximum freshet heights usually occur between the middle of March and the middle of April, the freshets occurring at other times not usually reaching a greater height than 4 to 6 feet above the normal high water. The number of freshets causing the water to rise above the level of the wharves on the main channel at Richmond average about one per year, and the water level seldom rises above the level of the city dock. The rise of water level due to freshets rapidly decreases below Richmond and is little felt at City Point.

Anchorage.—Hampton Roads and the channel off the wharves at Newport News are available as anchorage for large vessels. Vessels anchor anywhere near the channel of the river where the depth and width are suitable. Anchorage out of the way of traffic is permitted in the channel at Richmond, but vessels usually go to the wharves. Small boats anchor on the flats or in the cove having its entrance just westward of the entrance to the city dock. The harbor master at Richmond attends to the berthing and anchorage of vessels on request. The city has a tugboat ready to assist vessels.

Pilotage is not compulsory for James River above Newport News. Pilots can be obtained at Hampton Roads or Newport News, or at City Point for Appomattox River or James River above that point. The pilotage fee is \$1.50 per foot of draft between Newport News and any point on James River.

Supplies.—All kinds of supplies are obtainable at Newport News and Richmond. Gasoline and provisions can also be obtained at Smithfield, City Point, and Claremont, and there are stores at many of the other landings where some supplies are obtainable. Artesian water can be obtained at many of the landings.

Repairs.—Minor repairs to machinery can be made at Richmond and Petersburg, and there are small railways at Battery Park; but

the nearest dry dock is at Newport News, and extensive repairs to hulls and machinery can best be made there or at Norfolk.

Towboats can be had at Hampton Roads and Richmond. There is a municipal owned tug for assistance in Richmond Harbor.

Ice.—There is some drift ice in the river during severe winters, and at times the river is frozen over, interrupting navigation for a few days. Navigation to Richmond is hardly ever suspended 30 days at one time on account of ice.

Tides.—The mean rise and fall of tides is 2.5 feet in Hampton Roads, 2.8 feet at City Point, 3.4 feet at Dutch Gap, and 3.7 feet at Richmond.

Currents.—The currents follow the general direction of the channel except between Hog Island and Jamestown Island, where they set across Goose Hill Flats. Their velocities are very variable; in the lower reaches the flood current approximately equals the ebb in velocity; the main counteracting effect on the flood is the freshet current. The times of slack water also vary to a considerable extent, due principally to freshets, especially in the upper reaches of the river. The strength of current and the times of slack water in the following list are for normal conditions, and under abnormal conditions may differ, therefore, sometimes to a considerable extent.

At Newport News.—In the center of the channel off the shipyard slack water before flood occurs about 45 minutes after the time when the current turns northwest at Chesapeake Bay entrance, or approximately 2 hours 50 minutes before time of high water at Old Point Comfort), and slack water before ebb occurs about 45 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 3 hours 15 minutes before time of low water at Old Point Comfort). The mean velocity of the current at strength of flood or ebb is 1.4 knots.

In the center of the channel near **Point of Shoals Lighthouse** slack water before the flood occurs about 1 hour 25 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 1 hour before time of high water at Old Point Comfort), and slack water before ebb occurs about 1 hour 25 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 2 hours before time of low water at Old Point Comfort). The mean velocity of the current at strength of flood is 0.5 knot and at strength of ebb is 0.7 knot.

Off Claremont Landing, in the center of the channel, slack water before the flood occurs about 2 hours 40 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or at time of high water at Old Point Comfort), and slack water before ebb occurs about 2 hours 40 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or at time of low water at Old Point Comfort).

Off Wilcox Wharf slack water before the flood occurs about 3 hours after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 30 minutes after time of high water at Old Point Comfort), and slack water before the ebb occurs about 3 hours after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 40 minutes after time of low water at Old Point Comfort).

Off City Point slack water before the flood occurs about 3 hours 20 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 1 hour 10 minutes after the time of high water at Old Point Comfort), and slack water before the ebb occurs about 3 hours 20 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 1 hour 10 minutes after the time of low water at Old Point Comfort). The mean velocity of the current at strength of flood is 1.1 knots and at strength of ebb is 1.3 knots.

Above City Point the velocity of the current and times of slack water are very variable. At Richmond the currents are chiefly nontidal.

DIRECTIONS, JAMES RIVER.

From Newport News to City Point the channel is easily followed by day by vessels of 15 feet or less draft with the aid of the charts; strangers of deeper draft should take a pilot. The river is generally broad, but the channel is contracted by flats and middle grounds. The channel is well marked by lights and buoys; most of the dredged channels are marked by range lights, which do not show well as day marks and can not usually be seen at a greater distance than 1 to $1\frac{1}{2}$ miles.

There are fish traps in places on both sides of the channel from Newport News to City Point, but they are thickest below Point of Shoals lighthouse. Black and white horizontally striped buoys have been established to mark the outer limits of allowable areas.

1. **Newport News to Point of Shoals lighthouse.**—Passing about $\frac{1}{4}$ mile off the wharves at Newport News, steer 315° true (NW. $\frac{1}{2}$ N. mag.) until abreast buoy No. 3. Then bring the elevator at Newport News astern on a 300° true (NW. $\frac{7}{8}$ W. mag.) course, passing midway between White Shoal lighthouse and the black bell buoy off the entrance of Pagan Creek and to a position $\frac{1}{4}$ mile northeastward of the black buoy off Days Point.

Then steer 294° true (NW. by W. $\frac{3}{8}$ W. mag.) for Point of Shoals lighthouse with White Shoal lighthouse astern, to a position 350 yards northeastward of buoy No. 7. Then steer 271° true (W. $\frac{1}{2}$ N. mag.) on the Burwells Bay range, and follow the dredged cut (400 feet wide and 20 feet deep) from buoy No. 2 to buoy No. 2A. The range does not show well in the afternoon. Pass about 70 yards southward of buoy No. 2A and steer 290° true (NW. by W. $\frac{3}{4}$ W. mag.) for about $\frac{1}{2}$ mile to a position about 100 yards southwestward of buoy No. 2B, and with Point of Shoals lighthouse bearing 349° true (N. $\frac{1}{2}$ W. mag.) then steer 344° true (N. by W. mag.) to a position 250 yards westward of it.

2. **Point of Shoals lighthouse to Jamestown Island.**—Passing 250 yards westward of Point of Shoals lighthouse bring Point of shoals range (front light same as front light of Burwells Bay range) on over the stern, on a course 24° true (NNE. $\frac{1}{8}$ E. mag.), and be guided by it through a dredged cut (400 feet wide and 20 feet deep), which is marked by two black buoys. From the upper buoy, lying $1\frac{1}{4}$ miles above the lighthouse, steer 4° true (N. $\frac{3}{4}$ E. mag.) for $3\frac{3}{4}$ miles to a position 300 yards westward of Deep Water Shoals lighthouse, passing a long pier (Camp Eustis) below the light.

Then bring that lighthouse astern on a 337° true (N. by W. $\frac{5}{8}$ W. mag.) course until $2\frac{3}{4}$ miles from it and up with buoy No. 2. Leave this buoy 40 yards on the starboard hand and steer 305° true (NW. $\frac{1}{2}$ W. mag.) to buoy No. 4. Leave it 50 yards on the starboard hand and haul a little westward, so as to pass about 100 yards northward of the bell buoy off Hog Point. The directions of this paragraph lead through the **Hog Island Swash Channel** in a least depth of 15 feet, westward of a middle ground; the deeper channel, leading eastward of the middle ground, is buoyed and lighted but is about 1 mile longer.

From the bell buoy off Hog Point steer 245° true (WSW. $\frac{1}{4}$ W. mag.) for $1\frac{1}{2}$ miles to the red buoy at the entrance of the dredged cut, and then steer 229° true (SW. $\frac{3}{4}$ W. mag.) through the cut on the Goose Hill Channel range to the red bell buoy at the western end. The range does not show well in the afternoon.

3. **Jamestown Island to Claremont.**—Continue on the Goose Hill Channel range for $\frac{1}{4}$ mile past the bell buoy. Then steer 314° true (NW. $\frac{3}{8}$ N. mag.) to a position 300 yards southwestward of Church Point light at the end of Jamestown wharf. Then steer 308° true (NW. $\frac{1}{8}$ W. mag.) and pass 150 yards eastward of buoy No. 23 and bell buoy No. 25.

Pass 50 yards northward of the bell buoy and steer 265° true (W. mag.) for $1\frac{3}{4}$ miles with Swann Point Shoal range in line astern through a dredged channel 400 feet wide and 20 feet deep; 2 red buoys westward of the bell buoy mark the north edge of the cut. When past the latter one, bring Dancing Point Shoal Channel range in line ahead on the same course. This range leads through another cut, which is a continuation of the Swann Point Channel. When about $\frac{5}{8}$ mile from the front light and nearly up with buoy No. 25A, steer 301° true (NW. $\frac{3}{4}$ W. mag.), leaving buoy No. 10 on the starboard hand and then keeping near the middle of the river until abreast of Claremont.

4. **Claremont to Windmill Point.**—Continue the 301° true (NW. $\frac{3}{4}$ W. Mag.) course about $1\frac{1}{2}$ miles above the railroad wharves at Claremont, and when off the middle of the entrance to Chippoak Creek steer 328° true (NNW. $\frac{3}{8}$ W. mag.) for the small wharf at Brandon Point; a large brick barn is near the wharf. When $\frac{3}{8}$ mile past Brandon wharf light, bring it astern, on course 358° true (N. $\frac{1}{4}$ E. mag.), with Bachelor Point light ahead, passing 400 yards off the small wharf at Brandon Point. Favor slightly the north bank, keeping out of the bights in the bend north of Kennon Marsh and until off the entrance of Kittewan Creek. Then favor the south bank, keeping out of the bight at the mouth of Ward Creek. The ruins of an old pier, which sometimes show above water, stand on the edge of the flat at the mouth of Ward Creek.

Pass in mid-channel through the narrow part of the river at Weyanoke Point, and then follow the broad channel eastward of Minzie Middle Ground. The horizontally striped buoys marking the ends of the middle ground must be given a good berth when passing eastward of it, as shown on the chart.

A channel with a depth of 13 feet or more leads westward of Minzie Middle Ground. To go through this channel, steer 345° true (N. $\frac{7}{8}$

W. mag.) on the Wilcox Wharf range and pass westward of the two horizontally striped buoys marking the middle ground and 150 yards eastward of Windmill Point (marked by a thick clump of trees at the end). Wilcox Wharf range must be followed closely, as the range is slow. The range shows about 300 yards to the right of a water tank and about 50 yards to the right of the tallest clump of trees.

5. **Windmill Point to City Point.**—Pass midway between Windmill Point and Wilcox Wharf, and steer 251° true (WSW. $\frac{3}{4}$ W. mag.) on the Maycox Point range, leaving the black buoy northwestward of Windmill Point on the port hand and the red buoy southward of Bucklers Point on the starboard hand. The rear range has a triangular day mark showing above the trees.

Pass 200 yards off the south bank westward of the Maycox Point range, and steer 280° true (WNW. $\frac{5}{8}$ W. mag.) on the Jordan Point range (white slatted structure in range with the white square tower of Jordan Point lighthouse) and follow the buoyed dredged cut. Pass northward of buoy No. 31 and steer 293° true (NW. by W. $\frac{1}{2}$ W. mag.) on the Harrison Bar range astern. This range does not show well by day, but its approximate position is indicated by a lane cut in the woods.

When by buoy No. 16 steer 301° true (NW. $\frac{3}{4}$ W. mag.) on the North Flats lower range (white five-pile dolphins) and follow the buoyed channel. Pass 150 yards south of the front light and steer 268° true (W. $\frac{1}{4}$ N. mag.) leaving North Flats upper range light 150 yards to starboard. Then bring it on range over the stern (both ranges have common rear lights) course 239° true (SW. by W. $\frac{3}{4}$ W. mag.) and follow the channel marked by buoys and Wood Wharf light until past buoys 26 and 45. Then steer 313° true (NW. $\frac{1}{4}$ W. mag.) for the northeasterly edge of the western wharf at City Point. Anchorage may be had in the channel.

From Westover to City Point there are flats on one or both sides of the channel, which are nearly bare at low water and are generally indicated by ripples or the color of the water.

6. **City Point to Richmond.**—Local knowledge is necessary for vessels in this part of the river, and strangers should take a pilot. Small craft should have no difficulty in following the channel with the aid of chart No. 531. Wing dams which show above water extend out to the edges of the channels in places. In many places the shoals between these dams have been raised by deposit and now show above water or by the grass covering them.

Woodson Rock is bare at low water, and the Woodson Rock range leads clear of it. The range shows through a narrow opening in the trees, on top of a bluff.

Dutch Gap Canal, a short artificial cut 16 miles above City Point and 13 miles below Richmond, has ample depth and width, but the point on the north side at its easterly end must be given a berth of about 100 yards. The tidal currents offer considerable difficulty on account of the sharp bend, especially for tows. The southwest side of the canal is marked by a light on top of the bluff, and there are a prominent white house and monument near by. Navigation through the canal is difficult during freshets.

HAMPTON ROADS TO YORK RIVER.

Horseshoe is the shoal with depths less than 18 feet, which extends 5 miles from the shore between Old Point Comfort and Back River lighthouse, its southern edge bordering the north side of the channel into Hampton Roads. This shoal has depths of 13 to 18 feet over its eastern half; its western half has a least depth of 8 feet if the shore be given a berth of $\frac{1}{2}$ mile, but there are depths of 6 to 7 feet $\frac{3}{4}$ to 1 mile southeastward of Back River lighthouse. Its eastern extension is marked by a gas and bell buoy.

Local steamers and small craft of 7 feet or less draft with a smooth sea, plying between Hampton Roads, York River, and Mobjack Bay, use the following routes, varying the course as necessary to clear the fish traps: From southward of Old Point Comfort for 2 miles to the black and white buoy lying $1\frac{1}{2}$ miles westward of Thimble Shoal lighthouse. Then 27° true (NNE. $\frac{3}{4}$ E. mag.) for $4\frac{1}{2}$ miles to the perpendicularly striped bell buoy lying 2 miles eastward of Back River lighthouse. Then 336° true (N. by W. $\frac{5}{8}$ W. mag.) for $7\frac{3}{4}$ miles to the black buoy marking the channel of York River 2 miles westward of York Spit lighthouse; or, when going to Mobjack Bay, 350° true (N. $\frac{3}{8}$ W. mag.) for $7\frac{1}{2}$ miles and pass close westward of York Spit lighthouse. These courses lead across areas of possible fish traps.

A channel 400 yards wide, for the use of small craft, is kept clear of fish traps between Hampton Roads and the entrances of Back and York Rivers. From $1\frac{5}{8}$ miles eastward of Old Point Comfort lighthouse the westerly edge of this channel extends 15° true (N. by E. $\frac{7}{8}$ E. mag.) for $5\frac{3}{4}$ miles to a position $13\frac{3}{8}$ miles 56° true (NE. by E. $\frac{1}{2}$ E. mag.) from Back River lighthouse, and then 341° true (N. by W. $\frac{1}{4}$ W. mag.) for 7 miles to a position $\frac{1}{4}$ mile northeastward of the black buoy marking the channel of York River, 2 miles westward of York Spit lighthouse. The channel is marked on its western side by black and white buoys.

Buckroe Beach is a summer resort on the shore $2\frac{1}{2}$ miles north-northeastward of Old Point Comfort lighthouse. It has communication by electric road with Old Point Comfort, Hampton, and Newport News. The lights at night during the summer are prominent.

Back River, having its entrance $6\frac{1}{2}$ miles north-northeastward of Old Point Comfort, has a depth of about 9 feet across the bar at the entrance and 7 feet to abreast **Amorys Wharf** (Earnest post office), which is on the north side at the intersection of Northwest and Southwest Branch. Gasoline may be obtained at the wharf and general supplies $\frac{1}{2}$ mile up the road. There is telephone communication. There is a depth of 6 feet at the wharf. A large hangar and a water-tank, at Langley Field, on the peninsula between Northwest Branch and Southwest Branch are very prominent for many miles. Flashing flood lights on the water-tank are shown at night when airplanes are expected.

Northwest Branch has a depth of 6 feet for $\frac{3}{4}$ mile above the entrance and 2 feet to near the head. **Southwest Branch** has a depth of 4 feet for $1\frac{1}{2}$ miles, above which it shoals rapidly. **Harrison Creek**, on the south side of Back River, has a depth of 3 feet for $\frac{3}{4}$ mile; **Fox Hill** is a village on the east side near its head.

Back River is the center of a large oystering and fishing industry, and is also frequented by many produce boats, the deepest draft being 7 feet. **Back River lighthouse** (white tower showing against the trees) and a wharf and house on the western end of **Northend Point** are the most prominent marks in the approach. The main channel is narrow in places, but is marked by buoys and lights and is easily followed with the aid of the chart. The tributaries are unmarked. The shore and shoals near the entrance are subject to some change. A channel 800 yards wide and marked by black and white buoys is kept clear of fish traps in the approach, the south edge of this channel extending from the black buoy at the entrance through the perpendicularly striped bell buoy lying 2 miles eastward of Back River lighthouse. The mean rise and fall of tides at the mouth is 2.4 feet.

There are shoals, covered with scattered oyster rocks nearly bare at low water, extending from 1 to 2 miles offshore between Back River and Poquoson River entrances. Strangers, even in small boats, should keep outside of the 6-foot curve.

Poquoson River, on the south side of York River entrance, westward of York Spit lighthouse, has a depth of $6\frac{1}{2}$ feet to the village of Yorkville, where gasoline and some general supplies may be obtained, and 2 feet to near the heads of all its tributaries. The river is frequented by small produce boats and a few schooners and barges loading wood, the deepest draft being 9 feet. There are no wharves on the main branch except for small boats. The mean rise and fall of tides at the mouth is 2.4 feet.

Bennett Creek, on the southeast side, at the entrance of Poquoson River, has a depth of 6 feet for $1\frac{1}{2}$ miles above the entrance and is marked by buoys for $\frac{3}{4}$ mile. There is a marine railway near the head capable of hauling out boats of 75 tons and 6 feet draft.

Cheeseman Creek, on the north side of Poquoson River, just inside the entrance, has a depth of 6 feet in a narrow channel for 2 miles, and 3 feet nearly to the head. It is unmarked. There is an old fish factory on the northeast side $\frac{1}{2}$ mile west-northwestward of York Point, with a wharf extending to a depth of 7 feet. Gasoline and some provisions can be obtained near the head of the creek, and there is a railway capable of hauling out boats of 75 tons and 6 feet draft.

To enter Poquoson River, bring York Spit lighthouse astern on a 267° true (W. $\frac{1}{4}$ N. mag.) course and pass $\frac{1}{4}$ to $\frac{3}{8}$ mile northward of the black buoys off the north side of Poquoson Flats. This course leads through an area of possible fish traps. Pass about $\frac{1}{2}$ mile northwestward of buoy No. 3 and steer 215° true (SW. $\frac{3}{8}$ S. mag.), keeping about midway between the converging shores until the entrance buoys are sighted. Pass about $\frac{1}{4}$ mile northward of buoy No. 1 and steer westward, passing southward of buoy No. 2 and northward and well westward of buoy No. 5, above which the mid-channel is clear to Yorkville.

Back Creek, having its entrance 2 miles southward of Tue Marshes lighthouse, has a depth of 8 feet to abreast **Slates Wharf**, on the south side westward of **Clarkston Creek**, and 2 feet to near the head. The most prominent mark is an old fish factory on the south end of **Goodwin Islands**. The creek is frequented by fish steamers of 9 feet or less draft, and by many smaller oyster and produce boats. Gasoline and some provisions are obtainable near the head. The channel

is marked by buoys and Green Point lighted beacon as far as the entrance to Clarkston Creek. A 269° true ($W. \frac{3}{8} N.$ mag.) course with York Spit lighthouse astern will lead to the first black buoy.

The Thoroughfare, connecting Back Creek with York River westward of Goodwin Islands, has a depth of about 3 feet at high water and is extensively used by small local boats. The channel is usually marked by bush stakes, but is difficult without local knowledge.

YORK RIVER,

formed by the junction of Mattaponi and Pamunkey Rivers at West Point, 35 miles above the entrance, has a broad and comparatively straight channel with a least depth of 20 feet to West Point. It is marked by lights and buoys, and is easily followed by day with the aid of the chart.

The river has considerable trade, carried mostly in the regular steamers from Norfolk and Baltimore and in schooners and barges. The deepest draft ordinarily taken to West Point is 15 feet. The tributaries have a large trade in wood products carried in schooners and barges.

York Spit Swash, the slough leading through York Spit 5 miles northwestward of York Spit lighthouse and $1\frac{1}{4}$ miles southeastward of the marshy islands between York River and Mobjack Bay, had a least depth of 8 feet by the last survey, and is used by local vessels up to 7 feet draft. It is marked by buoys, but strangers should proceed with caution. On a bright day the channel shows up well.

Monday Creek is described under Mobjack Bay.

The Thoroughfare, connecting York River with Back Creek, is described above.

Sedger Creek, on the north side, 2 miles northwestward of Tue Marshes lighthouse, has a depth of $7\frac{1}{2}$ feet in a narrow, crooked channel to **Browns Wharf** (Perrin post office), at the bend $\frac{3}{8}$ mile above the entrance. A river steamer drawing 7 feet makes regular landings at two wharves in the creek. The channel is marked by an entrance lighted beacon (red structure) and buoys. A red sector in Tue Marsh light, from 137° to 158° (true), cuts buoy No. 2. There is a store at the wharf, and gasoline is obtainable. **Ellen Island**, on the west side at the entrance, is a marsh marked by a clump of trees.

Wormley Creek and **West Branch**, on the south side, 4 miles westward of Tue Marshes lighthouse, have a common entrance with a depth of 4 feet across the bar and 2 feet in both creeks nearly to the heads. They are little used. A naval fuel oil wharf is $1\frac{1}{2}$ miles eastward of Yorktown.

Sarah Creek, on the north side, 1 mile eastward of Gloucester Point, has a depth of about 7 feet in the entrance and for a short distance up the west branch, and 3 feet in either branch for about $\frac{3}{4}$ mile. The deepest draft using it is 7 feet. There are no wharves.

Yorktown is a town on the south side of York River, 6 miles above Tue Marshes lighthouse. The main part of the town is on the high bank and is not visible from the river. **Yorktown Monument** is a prominent mark. Pilots for the river to West Point can be obtained here.

Gloucester Point is a village on the point opposite Yorktown. The end of the point is low and marked by a wharf and a group of build-

ings. There is ferry communication with Yorktown. Gasoline and some provisions are obtainable.

Claybank and **Almondsville** are long wharves and post offices on the northeast side of the river $8\frac{1}{4}$ and $11\frac{3}{4}$ miles, respectively, above Gloucester Point. A long wharf in ruins and marked by a fixed white post light at the outer end is $2\frac{5}{8}$ miles northwest of Gloucester Point. A long prominent wharf, owned by the Navy, is $1\frac{3}{8}$ miles above Yorktown. There is a flashing red light shown from the outer end.

Timber Neck, **Bush**, **Carter**, and **Aberdeen Creeks**, between Carmines Islands and Claybank Wharf are shoal and frequented only by small local boats.

Kings Creek, on the southwest side, 4 miles above Yorktown, has a depth of 2 feet across the flats at the entrance and a little deeper water inside. It is little used.

Queens Creek, on the southwest side, $11\frac{1}{2}$ miles west-southwestward from Pages Rock lighthouse, has a depth of $2\frac{1}{2}$ feet across the flats at the entrance, 5 feet inside for $2\frac{1}{2}$ miles, and $1\frac{1}{2}$ feet for a farther distance of 2 miles to a fixed bridge $11\frac{1}{2}$ miles from the town of **Williamsburg**. It is used by a few produce boats in the lower end and by small motor boats to the bridge. The channel is difficult in places without local knowledge.

Poropotank Creek, 4 miles above Almondsville Wharf and eastward of Poropotank Creek light, has a depth of 6 feet in the entrance, $3\frac{1}{2}$ feet across **Morris Bay**, and 5 feet above to **Miller Landing**, $4\frac{1}{2}$ miles above the entrance. Small boats can go several miles farther. There are several landings on the creek from which wood products are shipped in boats of 6 to 7 feet draft. The channel is usually marked by bush stakes, but is crooked and narrow in places and difficult without local knowledge. The best water favors the east shore in the approach through Poropotank Bay.

West Point, at the junction of Mattaponi and Pamunkey Rivers, is the terminus of a branch of the Southern Railway, and is connected by daily steamer with Baltimore and the intermediate landings on York River. It has considerable trade in bay and coasting vessels, the deepest draft being 15 feet. Gasoline, provisions, water, and coal in limited quantities are obtainable. Towboats and pilots for Mattaponi and Pamunkey Rivers can be obtained. There is a machine shop for minor repairs to machinery and a railway capable of hauling out vessels of 150 tons, 120 feet length, and 12 feet draft.

Mattaponi River (chart 504) is the approach to the villages of **Walkerton** and **Aylett**, 25 and $33\frac{1}{2}$ miles, respectively, above West Point, and many other landings. It has a depth of 12 feet to **Mantapike**, $18\frac{1}{2}$ miles above West Point, and 10 feet to Walkerton. Between Walkerton and Aylett the river has been improved by dredging a channel $5\frac{1}{2}$ feet deep and 40 feet wide, but considerable trouble is experienced in maintaining it. There is a depth of about 2 feet for a distance of $2\frac{1}{2}$ miles above Aylett, where there is a fixed bridge, to the fixed bridge at **Dunkirk**. The river for a distance of 53 miles above Dunkirk is shoal, but is used for rafting and logging at high stages.

A steamer from West Point made regular trips to the principal landings on Mattaponi River as far as Walkerton in 1922. There

is also considerable trade in wood products carried in schooners and barges, the deepest draft being 14 feet. The river is unmarked, and navigation is difficult without local knowledge. Pilots and towboats can be obtained at West Point. Schooners usually carry a gasoline boat to assist them in the narrow channels. Supplies can best be obtained at West Point, though gasoline and provisions are usually obtainable at Walkerton and Aylett. Artesian water can be obtained at many of the landings.

Freshets occur at irregular intervals, being more severe during March and April, and have reached a height of $17\frac{1}{2}$ feet above mean low water at Aylett and 5 feet at Walkerton, though this is exceptional. The mean tidal range during low stages of the river is 2.9 feet at West Point, 3.6 feet at Walkerton, and 2.3 feet at Aylett.

Two highway **drawbridges** cross the Mattaponi River; one at West Point has a single lift opening 80 feet wide and has a headroom of 7 feet at high water when closed, and the other at Walkerton is a center pier draw, each opening 47 feet wide, and has a headroom of about 8 feet at high water when closed.

Pamunkey River (chart 504) has a depth of 15 feet to **Lester Manor**, 9 feet to the railroad bridge at **White House**, 7 feet to **Bassett Ferry**, and 5 feet to **New Castle bridge**, 24, 28, 43, and 45 miles, respectively, above West Point. It is navigable for small lighters and rafts for a farther distance of about 7 miles to **Hanover town**. The channel between White House and Bassett Ferry has been improved by dredging to a depth of 7 feet and width of 100 feet.

There are no towns on Pamunkey River, but there are many landings, from which considerable wood products and grain are shipped in schooners and barges, the deepest draft being 15 feet. There are post offices and railroad stations at **Sweethall** and **Lester Manor**, and a railroad station at **White House**.

From West Point to Sweethall Landing, $14\frac{1}{2}$ miles above, the river is **easy** of navigation with the aid of the chart. Above this point navigation is difficult without local knowledge. Pilots can be obtained at West Point, Lester Manor, and White House, and towboats at West Point. Artesian water can be obtained at several of the landings, and the river water is fresh above Cumberland Landing. There are several narrow cut-offs with sufficient depth for small boats, but local knowledge is usually necessary.

Freshets occur at irregular intervals in Pamunkey River, being more severe during March and April. The mean rise and fall of tides during low stages of the river is 2.9 feet at West Point and 1.7 feet at New Castle.

The railroad bridge at White House has a draw opening 46 feet wide and a headroom of 8 feet at high water when closed. The bridge at New Castle has a draw opening 40 feet wide and a headroom of about 13 feet at ordinary stage of the river, and sometimes not more than 7 feet during freshets. It is seldom opened.

Anchorage.—Vessels can anchor anywhere in the wider part of the channel of York River where the depth is suitable. A good anchorage for deep draft vessels is eastward or northwestward of Gloucester Point, on the north side of the channel. There is anchorage in the channel off the wharves on either side of West Point in depths of 18 to 40 feet. The areas eastward of Yorktown are used by naval vessels.

Pilots.—Pilotage is compulsory as far as Yorktown for all vessels other than those exclusively engaged in the coastwise trade and those made exempt by United States statutes. Vessels required to take a pilot will get one at Chesapeake Bay entrance or Hampton Roads. Pilots can be obtained at Yorktown for the river above that point. Pilots for Mattaponi and Pamunkey Rivers can be obtained at West Point.

Towboats.—Sailing vessels seldom take a towboat, but usually carry a small motor boat to assist them. Towboats for York River can be obtained at Hampton Roads, and for Mattaponi and Pamunkey Rivers at West Point.

Supplies.—Gasoline and provisions can be obtained at Yorktown, Gloucester Point, and West Point, and water and coal in limited quantities at West Point.

Repairs to small vessels can be made at West Point, but extensive repairs to machinery and to hulls of large vessels can best be made at Baltimore, Newport News, or Norfolk.

Freshets occur in Mattaponi and Pamunkey Rivers, but are little felt at West Point or below. The river is not fresh below West Point.

Ice sometimes interferes with navigation for short periods during severe winters, but in ordinary winters navigation is not interrupted below West Point.

Tides.—The mean rise and fall of tides is 2 feet at the entrance, 2.4 feet at Yorktown, and 2.9 feet at West Point.

Currents.—The currents follow the general direction of the channel, except in its narrowest parts, where they have a tendency to set a vessel on shoals. The velocity of the current and the times of slack water vary somewhat in York River, and to a considerable extent in the Mattaponi and Pamunkey Rivers, due principally to freshets, but also to some extent to winds.

At York Spit Lighthouse slack water before the flood occurs about 45 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 2 hours 30 minutes before time of high water at Washington, or 3 hours 20 minutes before time of high water at Old Point Comfort). Slack water before the ebb occurs about 45 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 3 hours 20 minutes before time of low water at Washington, or 3 hours 30 minutes before time of low water at Old Point Comfort).

Off Claybank slack water before the flood occurs about 1 hour before the time when the current turns northwest at Chesapeake Bay entrance (or approximately 2 hours before time of high water at Washington), and slack water before the ebb occurs about 1 hour before the time when the current turns southeast at Chesapeake Bay entrance (or approximately 2 hours 40 minutes before time of low water at Washington). In the York River below West Point the observed velocity of current at strength of flood was 1.2 knots and at strength of ebb was 1.5 knots.

Just below West Point, opposite Goff Point, slack water before the flood occurs about 30 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 1 hour 10 minutes before time of high water at Washington), and slack water before the ebb about 30 minutes after the time when the current turns

southeast at Chesapeake Bay entrance (or approximately 1 hour 45 minutes before time of low water at Washington).

In the Mattaponi River the flood and the ebb currents commence running about 40 minutes to 1 hour before they do in the Pamunkey River. The observed velocity of the currents in the Mattaponi River, between West Point and Walkerton, was 1.1 knots on the ebb and about 1 knot on the flood.

In the Pamunkey River, between West Point and Bassett Ferry, the observed velocity of the currents was 1.15 knots on the ebb and about 1 knot on the flood.

In the Mattaponi River, at Mattaponi, slack water before the flood occurs about 2 hours 15 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 20 minutes before time of high water at Washington), and slack water before the ebb occurs about 2 hours 15 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 1 hour 40 minutes before the time of low water at Washington).

In the Pamunkey River, at White House railroad bridge, slack water before the flood occurs about 3 hours after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 30 minutes after time of high water at Washington), and slack water before the ebb occurs about 3 hours after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 15 minutes after time of low water at Washington).

DIRECTIONS, YORK RIVER.

The easterly limit of the fish traps off Mobjack Bay and York River is defined by a line extending 188° true (S. by W. $\frac{1}{4}$ W. mag.) from buoy No. 11, southeastward of Wolf Trap lighthouse, leading for the perpendicularly striped bell buoy lying 2 miles eastward of Back River lighthouse until $3\frac{1}{4}$ miles from it, then trending 168° true (S. $\frac{5}{8}$ E. mag.) for $3\frac{3}{4}$ miles, to a position $1\frac{1}{4}$ miles eastward of the bell buoy. Channels leading into Back River, York River, and Mobjack Bay are kept clear of fish traps, and should be used by strangers at night. Above Tue Marshes lighthouse fish traps will be found in places on the shoals to the edges of the channel. The easterly limit of fish traps in Chesapeake Bay, and the limits of the clear channels leading into York River and Mobjack Bay are marked by black and white buoys.

The routes used by local steamers of 7 feet or less draft crossing the Horseshoe, and easterly limit of the fish traps on that shoal, are described on page 125. The directions of section 1 are good for a least depth of 34 feet, and section 1A for 15 feet. Vessels of 15 feet or less draft should have no difficulty in the daytime, in following the directions from Yorktown to West Point with the aid of the chart.

1. Main entrance to Yorktown.—A channel 1,200 yards wide is kept clear of fish traps in the main entrance of York River up to Tue Marshes lighthouse. It has least depths of 34 to 35 feet and is good for vessels of the deepest draft. From entrance, lying $3\frac{3}{4}$ miles 152° true (SSE. mag.) from York Spit lighthouse, the center line

of the channel trends 318° true (NW. $\frac{3}{4}$ N. mag.) to York Spit lighthouse abeam, distant $\frac{7}{8}$ mile, then 307° true (NW. $\frac{1}{4}$ W. mag.) for $2\frac{3}{4}$ miles to nun buoy No. 2A abeam, distant 600 yards, and then 289° true (NW. by W. $\frac{7}{8}$ W. mag.) with York Spit lighthouse astern and passes 600 yards northward of buoy No. 3. At night a white sector in York Spit lighthouse covers the fairway between the southwest edge of York Spit and the northeast edge of the shoals off Tue Point.

Continue the last course until Tue Marshes lighthouse bears 230° true (SW. $\frac{7}{8}$ W. mag.) distant $\frac{3}{4}$ mile. Then steer 259° true (W. $\frac{1}{2}$ S. mag.), passing $\frac{3}{8}$ mile northward of Tue Marshes lighthouse and buoy No. 5. Then bring Tue Marshes lighthouse astern on a 268° true (W. $\frac{1}{4}$ N. mag.) course, passing about $\frac{3}{8}$ mile southward of buoy No. 4. When Gloucester Point light (red post on end of point) bears 302° true (NW. $\frac{5}{8}$ W. mag.), steer 293° true (NW. by W. $\frac{1}{2}$ W. mag.), pass midway between Gloucester Point and Yorktown, and proceed as directed in section 2.

1A. Entering from northward.—A channel 800 yards wide is kept clear of fish traps, the center line of the channel trending 223° true (SW. $\frac{1}{4}$ W. mag.) and passing $\frac{5}{8}$ mile northwestward of New Point Comfort Middle Ground buoy No. 7 and $1\frac{1}{4}$ miles northwestward of York Spit lighthouse. This channel leads in a least depth of 15 feet across York Spit, to bell buoy No. 2. When across the spit, bring York Spit lighthouse astern on a 289° true (NW. by W. $\frac{7}{8}$ W. mag.) course, passing 600 yards southward of nun buoy No. 2A and the same distance northward of buoy No. 3. Then follow the directions in the preceding paragraph.

2. Yorktown to Claybank.—Passing midway between Gloucester Point and Yorktown steer 317° true (NW. $\frac{5}{8}$ N. mag.) for $2\frac{3}{8}$ miles, heading for Pages Rock lighthouse, to a position about 300 yards northeastward of nun buoy No. 7. Then steer 307° true (NW. $\frac{1}{4}$ W. mag.) and pass about 300 yards southwestward of buoy No. 6.

When Pages Rock lighthouse bears 348° true (N. $\frac{5}{8}$ W. mag.), steer 336° true (N. by W. $\frac{5}{8}$ W. mag.) for the end of the long wharf at Claybank, and leave the lighthouse nearly $\frac{1}{4}$ mile on the starboard hand and buoy No. 9 on the port hand.

3. Claybank to West Point.—Pass 200 yards off the wharf at Claybank and steer 320° true (NW. $\frac{7}{8}$ N. mag.), following the buoyed channel, passing 300 yards northeastward of Middle Ground light (black pile structure), 300 yards southwestward of Purtan Bay light (on end of the long wharf at Almondsville), and 200 yards southwestward of Purtan Island light (red pile structure). Poropotank Creek light will be ahead on this course.

Passing 200 yards southwestward of Purtan Island light, steer 317° true (NW. $\frac{5}{8}$ N. mag.) and pass 200 yards southwestward of Poropotank Creek light and 250 yards southwestward of buoy No. 10. Then steer 332° true (NNW. mag.) for Bells Rock lighthouse and pass buoy No. 13 at a distance of about 200 yards.

Pass 150 yards southwestward of Bells Rock lighthouse and bring it astern on a 299° true (NW. by W. mag.) course, heading about 150 yards northward of Fillbates light (black structure), near the south end of the jetty. Pass through a channel on a 331° true (NNW. $\frac{1}{8}$ W. mag.) course, following the black buoys which mark its western

side at a distance of 100 yards. Continue the course and anchor off the railroad wharves at West Point, favoring that side.

Nine feet can be carried across the point of shoal separating the Mattaponi and Pamunkey Rivers, between nun buoy No. 12 and the red and black buoy $\frac{7}{8}$ mile north-northeastward of it. Gasoline may be obtained from docks along the east side of the town.

MOBJACK BAY (CHART 494),

having its entrance between York Spit and New Point Comfort, has several tributaries, the most important being East, North, Ware, and Severn Rivers. It is obstructed by extensive shoals, but has a depth of 22 feet in the entrance and 15 feet through the bay and for a considerable distance in the tributaries.

The entrance is marked on the north side by **New Point Comfort lighthouse** (white tower) and on the south side by **York Spit lighthouse** (white house on piles), and these are the only prominent marks in the approach. Many of the shoals in the bay and tributaries are marked by buoys and lights. Steamers from Norfolk make regular trips to the principal wharves in Mobjack Bay and tributaries, and they are also frequented by produce boats and by others engaged in oystering and fishing. A good anchorage can be found in the bay, with shelter from all but southerly and southeasterly winds. Small craft find safe anchorage in the bight westward of New Point Comfort and in the rivers and creeks. Gasoline may be obtained at Bayside wharf, $\frac{3}{4}$ mile northwestward of the first-mentioned anchorage.

New Point Comfort, marked by a lighthouse, is low and sparsely wooded and has a wharf on its west end at which the steamers make landings during the fishing season. Gasoline is obtainable.

Bayside Wharf is a long wharf on the northeast side of Mobjack Bay, $1\frac{3}{4}$ miles northwestward of New Point Comfort lighthouse.

East River, emptying into Mobjack Bay from northward, has a narrow channel with a depth of 13 feet for 4 miles above the entrance and 4 feet for a farther distance of 2 miles to near the head. The entrance is marked by **Pultz Bar light** and by buoys. Unmarked shoals extend for some distance off many of the points above the entrance, but the mid-channel is clear if the points be given a good berth.

There are four wharves with post offices on East River: **Philpots** (Mobjack post office), on the west side, and **Diggs** (Traders post office), on the east side, just inside the entrance, and **Williams and Hicks Wharves**, about $3\frac{1}{4}$ miles above the entrance. Gasoline and provisions can be obtained at Mobjack, and there is a railway capable of hauling out boats of 40 tons, 40 feet length, and 5 feet draft. There is a store at Williams Wharf and a railway capable of hauling out vessels of 100 tons, 50 feet length, 8 feet draft aft, and 6 feet forward. Gasoline can be obtained here.

North River, emptying into the head of Mobjack Bay from northward, is wide, but has shoals making off for a long distance from many of the points. The channel is marked by lights and buoys. **Auburn Wharf**, on the north bank 4 miles above the entrance, and **Dixondale Wharf**, on the west bank 5 miles above the entrance, are the principal landings, and have depths of 7 feet at the ends. There

is a depth of 12 feet in the channel to abreast Auburn Wharf, and 8 feet to abreast Dixondale Wharf.

Ware River, emptying into the head of Mobjack Bay from north-westward, has a depth of 15 feet to the mouth of **Wilson Creek**, 3 miles above the entrance, and 8 feet for a farther distance of 2 miles. Shoals, some of them marked by buoys, extend for a long distance off many of the points. The landings are **Roanes Wharf** and **Baileys Wharf** on the west side, and **Hockley Wharf** on the east side, distant $3\frac{1}{4}$, $4\frac{1}{4}$, and $4\frac{3}{4}$ miles, respectively, above the entrance. Gasoline is obtainable at Baileys Wharf.

Severn River, emptying into Mobjack Bay from southwestward, has a depth of 15 feet to the junction of Northwest and Southwest Branches, and 8 feet for $1\frac{1}{4}$ miles in **Southwest Branch** and $1\frac{3}{4}$ miles in **Northwest Branch**. The most prominent shoals are marked by buoys. **Severn Wharf** is on the south side of Southwest Branch $1\frac{1}{8}$ miles above the fork. There is a store here, and gasoline is obtainable. There are wharves, used by local boats, on Northwest Branch about 1 and 2 miles above the entrance.

Monday Creek, forming a thoroughfare between Mobjack Bay and York River, has a depth of about 3 feet at high water and is extensively used by small local boats. It is difficult without local knowledge.

Pilots.—There are no regular pilots for Mobjack Bay and tributaries, though a pilot can usually be obtained from boats at work near the entrance.

Tides.—The mean rise and fall of tides is about 2 feet.

DIRECTIONS, MOBJACK BAY.

See the remarks relating to fish traps in the directions for York River; also section 1A of that heading for the channel which is kept clear of fish traps, leading across Mobjack Bay entrance inside of New Point Comfort Middle Ground.

A channel 800 yards wide is kept clear of fish traps in the main entrance of Mobjack Bay. Passing 400 yards southwestward of Middle Ground Shoal north end gas and whistling buoy, the center line of the channel trends 320° true (NW. $\frac{7}{8}$ N. mag.) until New Point Comfort lighthouse bears 88° true (E. $\frac{1}{4}$ S. mag.), distant nearly 2 miles, and then 333° true (N. by W. $\frac{7}{8}$ W. mag.) for Pultz Bar light. The latter course leads a little westward of a depth of 10 feet on the edge of the shoal $1\frac{5}{8}$ miles south-southeastward of Pultz Bar light.

. Any other course into the bay leads across areas of possible fish traps, and should be used with caution by strangers at night. The routes used by local steamers of 7 feet or less draft crossing the Horseshoe are described on page 125. Passing $\frac{1}{4}$ mile westward of York Spit lighthouse, a 333° true (N. by W. $\frac{7}{8}$ W. mag.) course will lead for Pultz Bar light, but leads through an area of possible fish traps until New Point Comfort lighthouse bears a little forward of the beam.

To East River.—Standing for Pultz Bar light on a 333° true (N. by W. $\frac{7}{8}$ W. mag.) course, when about 1 mile from it steer 349° true (N. $\frac{1}{2}$ W. mag.) and pass about $\frac{1}{4}$ mile eastward of the light and 100 yards or more westward of buoy No. 2. Then bring the

light astern on a 24° true (NNE. $\frac{5}{8}$ E. mag.) course, passing 100 yards eastward of the black buoy nearly opposite Diggs Wharf. Then follow the west bank for about $1\frac{1}{2}$ miles until around the first bend, taking care to give the points on that side a berth of 300 to 400 yards. Then keep near mid-river, except at Williams Wharf, which should be rounded at a distance of 100 to 150 yards.

To North River.—Pass $\frac{1}{2}$ mile southwestward of Pultz Bar light, steer 310° true (NW. mag.), and pass about 200 yards northeastward of Ware Point Shoal light. Then bring the latter light astern on a 342° true (N. by W. $\frac{1}{8}$ W. mag.) course, pass 100 yards eastward of a black buoy, and continue the course to a position $\frac{1}{4}$ mile eastward of Love Point light. Then steer 287° true (WNW. mag.) and pass 100 yards northward of Love Point light and 150 yards southward of Cradle Point light. Above the latter light the deeper water favors slightly the west bank to Dixondale Wharf.

To Ware River.—Passing $\frac{1}{2}$ mile south-southwestward of Pultz Bar light, steer 287° true (WNW. mag.), heading just clear of the end of Windmill Point, and pass 200 yards southward of buoy No. 2, southward of Ware Neck Point. Continue the course nearly $\frac{1}{2}$ mile past buoy No. 2, and then steer 309° true (NW. mag.) to a position northward of buoy No. 1. Then steer 270° true (W. $\frac{1}{2}$ N. mag.) until Windmill Point is abeam, and then steer 242° true (WSW. mag.) to a position about 300 yards east-southeastward of buoy No. 4. Pass 100 to 200 yards southward of the buoy, 200 yards northward of Roanes Wharf, and anchor north-northeastward of the wharf and before reaching buoy No. 3. The channel is close eastward of the latter buoy and is narrow.

To Severn River.—A 284° true (WNW. $\frac{1}{4}$ W. mag.) course with New Point Comfort lighthouse astern will lead northward of buoy No. 1 at the entrance, but leads across an area of possible fish traps in the bay. To insure clearing the fish traps, pass not more than 1 mile southward of Pultz Bar light, and bring it astern on a 230° true (SW. $\frac{7}{8}$ W. mag.) course to the entrance.

Pass 150 yards northwestward of buoy No. 1 and steer 242° true (WSW. mag.) for 1 mile. Then follow the north bank at a distance of $\frac{1}{4}$ mile and pass 100 yards northward of buoy No. 3, at the entrance to Southwest Branch. In Southwest Branch pass well westward of buoy No. 3, favor the western point at the entrance, passing it at a distance of 350 yards, and then keep near the middle for a distance of 1 mile to the landing. In Northwest Branch the channel is near the middle, keeping out of the bights; about 1 mile above buoy No. 3 the channel leads northward and westward of buoy No. 5, between it and the wharf at Cod Point (north bank).

MOBJACK BAY TO PIANKATANK RIVER.

The shoals on the west side of Chesapeake Bay between Mobjack Bay and Rappahannock River are generally more or less obstructed by fish traps during the fishing season. The easterly limit of the fish traps extends from the black bell buoy at the end of Rappahannock Spit to buoy No. 11, southward of Wolf Trap lighthouse, and thence to within $3\frac{1}{4}$ miles of the bell buoy lying 2 miles eastward of Back-River lighthouse. It is marked by black and white buoys.

Horn Harbor, 3 miles northward of New Point Comfort lighthouse, has a depth of about $3\frac{1}{2}$ feet across the bar at the entrance and 6 to 15 feet in a narrow channel inside for about 2 miles above the bar. It is considerably used as a harbor by fishing and oyster boats. The depth of the bar is subject to some change. The best water favors the western shore in entering and is marked by light beacons.

Winter Harbor and the other sloughs and creeks having their entrance $4\frac{1}{2}$ miles north-northeastward of New Point Comfort lighthouse are shoal at the entrance and generally consist of mud flats bare at low water inside. They are little used.

PIANKATANK RIVER (CHART 534),

just south of Rappahannock River entrance, has a depth of 12 feet to within $2\frac{1}{2}$ miles of the village of Freeport, and 6 feet to Freeport. Small boats and lighters can go several miles above Freeport. Steamers from Baltimore drawing 6 feet make landings in Milford Haven. River landings above this point are served by connecting gasoline launches. Schooners up to 12 feet draft carrying wood products also make use of the river.

The river is marked by **Stingray Point** lighthouse (white house on piles), on the north side at the entrance, and by several lights and buoys, but the channel is obstructed by many shoal spits and middle grounds. Strangers should have no trouble in taking a draft of 10 feet to **Doctor Point**, 11 miles above the entrance, with the aid of the chart.

Between Doctor Point and Freeport the channel is shoal and very narrow in places. It is usually marked by bush stakes but is difficult without local knowledge. Schooners and barges usually complete their loading from lighters about $2\frac{1}{2}$ miles below Freeport. Gasoline and some provisions can be obtained at **Green Point** (Dixie post office) southward of Wilton Point, and at Freeport.

Hills Bay, on the south side of Piankatank River just inside the entrance, forms the approach to Milford Haven and Queens Creek.

Milford Haven can be entered from Piankatank River at the northwest end and from Chesapeake Bay at the southeast end. The entrance at the southeast end has a depth of 3 feet and is used by small local boats, but is unmarked, exposed to a heavy sea, and difficult without local knowledge. The main entrance, at the northwest end, has been improved by dredging a channel 10 feet deep and 200 feet wide from Hills Bay to **Callis Wharf** (Grimstead post office), on the north side $\frac{3}{4}$ mile above the entrance, and by the construction of a jetty 1,200 feet long on the north side at the entrance. There is a depth of $6\frac{1}{2}$ feet from Callis Wharf to **Fitchetts Wharf** and post office, on the south side of **Stutts Creek** 3 miles above. Steamers from Baltimore drawing 8 feet make regular trips to the landings in Milford Haven as far as Fitchetts Wharf. The entrance to the dredged channel is marked by a buoy, and the most prominent shoals as far as Fitchetts Wharf are marked by single pile beacons with slatted daymarks, maintained by steamboat company.

In entering **Milford Haven** a 185° true (S. by W. mag.) course with Stove Point light astern will lead through Hills Bay to the entrance. Pass 75 yards eastward of the red buoy, follow the jetty at a distance of 60 yards to the inner end, and then head for **Cricket Hill**

Wharf. From this wharf steer 45° true (NE. $\frac{1}{2}$ E. mag.) with Callis Wharf a little on the port bow for 350 yards, to avoid a shoal on the northwest side, marked by a beacon, and then bring Callis Wharf well on the starboard bow until close to it to avoid a shoal making off the southern shore, nearly bare at extreme low water and marked by a beacon. From Callis Wharf to Fitchetts Wharf follow a general mid-channel course and give the points a good berth, being guided by the chart. There are stores at Callis Wharf, and gasoline is obtainable.

Queens Creek, at the southwest end of Hills Bay, has a depth of 6 feet inside for 1 mile, and $2\frac{1}{2}$ feet to near the head, but is obstructed by a bar with a depth of $1\frac{1}{2}$ feet at the mouth. It is frequented only by small local boats and is unmarked.

Ice.—Piankatank River is closed by ice for short periods only, during severe winters.

Tides.—The mean rise and fall of tides is 1.2 feet at the entrance.

DIRECTIONS, PIANKATANK RIVER.

From southward.—The easterly limit of possible fish traps off Piankatank River entrance is a line joining Rappahannock Spit bell buoy and the black buoys off Wolf Trap lighthouse and is marked by a line of black and white horizontally striped buoys. Vessels approaching from southward, in order to avoid areas of possible fish traps, should keep outside this line until $2\frac{5}{8}$ miles southward of Rappahannock Spit gas buoy and $1\frac{1}{8}$ miles northward of the third fish trap buoy northward of Wolf Trap lighthouse. Then steer 266° true (W. $\frac{1}{8}$ N. mag.) for $5\frac{5}{8}$ miles, passing $\frac{3}{8}$ mile northward of buoy No. 1 and to a position 400 yards northward of buoy No. 3.

From northward.—Pass eastward and $\frac{1}{2}$ mile southward of Rappahannock Spit gas buoy, and steer 245° true (WSW. $\frac{1}{4}$ W. mag.), heading for the end of Stove Point, for 6 miles, passing $\frac{3}{4}$ mile south-southeastward of Stingray Point lighthouse, and to a position 400 yards northward of buoy No. 3.

Cherry Point to Roane Point.—Pass $\frac{1}{4}$ mile westward of buoy No. 3 and steer 189° true (S. by W. $\frac{1}{4}$ W. mag.), so as to pass 200 yards westward of Cherry Point light and the same distance eastward of Stove Point light. Pass southward and 300 yards southwestward of Stove Point light and head northwestward for $\frac{1}{4}$ mile until northward of a black buoy. From here a 289° true (NW. by W. $\frac{3}{4}$ W. mag.) course for $1\frac{1}{2}$ miles, with Roane Point light a little on the starboard bow, will lead to a position $\frac{3}{8}$ mile northeastward of Iron Point, and then a 307° true (NW. $\frac{1}{4}$ W. mag.) course for $1\frac{1}{8}$ miles will lead to a position 350 yards northward of Roane Point light. Above this point the chart is the guide.

RAPPAHANNOCK RIVER,

on the western side of Chesapeake Bay, 40 miles above the entrance and 111 miles below Baltimore, is the approach to the city of Fredericksburg, at the head of navigation 95 miles above the entrance, and to numerous villages and landings. Steamers from Baltimore and Norfolk of 7 to 10 feet draft make regular trips to the prin-

cipal wharves on the river and its tributaries as far as Fredericksburg. The lower end of the river is frequented by fish steamers of 9 to 11 feet draft, and by many smaller craft engaged in the oystering and fishing industry. Fredericksburg has some trade in wood products, carried mostly in barges of 8 to 9 feet draft. The tributaries have some trade in farm and wood products, carried in barges, lighters, and schooners.

Channel.—Rappahannock River has a natural channel 30 feet deep for 26 miles, and 14 feet deep to the town of Tappahannock, 39 miles above the entrance. Above Tappahannock the river is being improved to obtain a channel 12 feet deep and 200 feet wide to the town of Port Royal, 25 miles below Fredericksburg, and 12 feet deep and 100 feet wide to Fredericksburg. The project has been completed but is subject to some shoaling in places. In 1922 there was a depth of 9.3 feet to Fredericksburg.

Westland Wharf and post office is on the north side, $\frac{3}{4}$ mile westward of Windmill Point. **North End Wharf** (Grinels post office) is on the south side, 3 miles westward of Stingray Point. Each is distinguished by several white buildings on the end of the wharf.

Mill Creek and **Lockley Creek**, on the south side of Rappahannock River 6 miles westward of the entrance, have depths of 5 feet or more until well inside the entrances, and are frequented by many small local craft. There are railways in both creeks capable of hauling out boats of 30 feet length and 4 feet draft. The approach to Mill Creek is marked by two lights. Mill Creek wharf, eastward of the entrance to Mill Creek, can be reached with a draft of 9 feet at low water. To enter, give the edge of the shoal northeastward of Parrot Island a good berth, steer 231° true (SW. by W. mag.) for the outer light, and pass 50 yards eastward of it on a 197° true (SSW. mag.) course. To go farther in, the best water will be carried by passing about 200 feet off the wharf, the same distance southward and westward of the inner light, and then with that light astern steer for **Clarks** (formerly **Woodland**) **Wharf** until less than 300 yards from it.

Whitestone Wharf (Taft post office), marked by a prominent red building, is on the north side of Rappahannock River 6 miles above Windmill Point. There is a fish factory and wharf on Cherry Point.

Carter Creek, on the north side of Rappahannock River $9\frac{1}{2}$ miles above Stingray Point, is the approach to the villages of **Weems** and **Irvington**. It has several oyster houses and a fish factory, is the center of a large oystering and fishing industry, and is extensively used as an anchorage by a local vessels. The channel has been improved by dredging to a depth of 15 feet and width of 200 feet across the bar at the entrance and to a depth of 12 feet and width of 100 feet to Irvington, and is marked by lights. A jetty makes off the eastern point parallel to the channel.

There are several railways in Carter Creek, the largest capable of hauling out vessels of 200 tons, 148 feet length, 8 feet draft aft and 6 feet forward; ordinary repairs to machinery can be made. Storm warnings are displayed at Weems. The mean rise and fall of tides is 1.4 feet.

To enter Carter Creek, pass 40 yards eastward of the outer light, westward of a bush stake marking a shoal extending off the jetty, 40 yards westward of the second light, and not over 100 yards east-

ward of Weems Wharf. Good anchorage can be had anywhere in mid-channel above the wharf. To go to Irvington, follow a general mid-channel course and give the points a good berth; the third light should be left 75 yards on the port hand.

Corrotoman River, on the north side of Rappahannock River 12 miles above the entrance, has a depth of 18 feet to the junction of Eastern and Western Branches, 4 miles above the entrance. **Eastern Branch** has a depth of 9 feet for $2\frac{1}{2}$ miles and 6 feet for a farther distance of $\frac{3}{4}$ mile. **Western Branch** has a depth of 12 feet for $2\frac{1}{2}$ miles and 6 feet for a farther distance of 1 mile. The channel is obstructed by shoal spits and middle grounds, but the principal shoals as far as the fork, and for $\frac{1}{2}$ mile above in Western Branch, are marked by buoys and lights. **Millenbeck Wharf** and post office, on the western side $1\frac{1}{2}$ miles above the entrance, and **Ottoman Wharf** and **Merry Point Wharf** and post office, on Western Branch, $\frac{3}{4}$ and 1 mile, respectively, above the fork, are the principal landings. There are stores at Millenbeck and Merry Point. The mean rise and fall of tides is 1.4 feet.

To enter **Corrotoman River** head for Millenbeck Bar buoy No. 1 on any course between 357° true (N. $\frac{1}{4}$ E. mag.) and 33° true (NE. $\frac{1}{2}$ N. mag.). Pass eastward and northward of it and steer west-northwestward with Corrotoman Point light on the starboard bow, pass westward of the light and 250 yards eastward of Millenbeck Wharf. Then steer northeastward, passing 300 yards eastward of the point $\frac{3}{4}$ mile northeastward of the wharf. Then pass westward of buoy No. 4 on a northerly course, and when well past it steer north-northeastward and pass westward of buoy No. 6 and eastward of Bar Point light. The chart is the best guide in the branches.

Burhans Wharf (Cooper post office) is on the south side of Rappahannock River southwestward of the entrance to Corrotoman River.

Urbana Creek, on the southwest side of Rappahannock River, 15 miles above the entrance, has been improved by dredging a channel 10 feet deep and 150 feet wide across the bar at the entrance, and to the steamboat wharf at Urbana $\frac{1}{2}$ mile above, with a turning basin of the same depth off the wharf. The creek has a depth of 6 feet for $\frac{3}{4}$ mile above the steamboat wharf, and is extensively used as a harbor for small vessels. There is excellent anchorage for a limited number of vessels of 9 feet or less draft, and depths of 4 to 9 feet at the wharves. It is frequented by passenger steamers, schooners, and barges of 10 feet or less draft. The mean rise and fall of tides is 1.6 feet. There is a railway at Urbana for hauling out boats of 50 feet length and 5 feet draft, and a machine shop for ordinary repairs to motors.

The entrance of Urbana Creek is marked by a buoy and two lights, and there is a large brick factory on the north side of the entrance. To enter, approach the outer light on a westerly course, pass 100 feet southward of it and the red buoy near the inner end of the jetty, pass about midway between the wharf just westward of the red buoy and the inner light, and then keep in mid-channel to the steamboat wharf at the north end of the bridge. The bridge crossing Urbana Creek has a sliding draw with an opening 27.8 feet wide.

There is a long wharf at **West Urbana** (Remlik), $\frac{3}{4}$ mile northwestward of the entrance to Urbana Creek, at which the steamers make

regular landings. A water tank on shore and the white buildings on the end of the wharf are prominent.

Robinsons Creek, just northward of West Urbana, has a depth of 5 feet in the entrance and 3 feet to the head.

La Grange Creek, $1\frac{3}{4}$ miles northward of Urbana Creek, has a depth of 7 feet in the entrance and 3 feet for $1\frac{1}{2}$ miles above.

Weeks Creek, on the southwest side of the river 4 miles above Urbana Creek, has a depth of about 2 feet and is seldom used.

Monaskon is a post office and wharf on the northeast side of the river, $5\frac{1}{2}$ miles above Urbana Creek.

Waterview is a wharf and post office on the southwest side of the river 6 miles above Urbana Creek. Just westward of Waterview is **Parrotts Creek**, which has a depth of 4 feet in the entrance and 2 feet to near the head. **Mud Creek**, just northward of Parrotts Creek, is generally bare at low water inside.

Deep Creek, on the northeast side of Rappahannock River 8 miles above Urbana Creek, has a depth of 2 feet across the flats at the entrance and 4 to 6 feet inside to the several branches. The deepest draft using it is about 4 feet.

Whealton Wharf (**Morattico** post office), on the northeast side of the river $9\frac{1}{2}$ miles above Urbana Creek, is an important shipping point. The long wharf and several buildings on the end are prominent. **Mulberry Creek**, just eastward of the wharf, has a depth of 4 feet at the entrance and 2 feet to the head. Just westward of Whealton Wharf is **Lancaster Creek**, which has a depth of 5 feet for 1 mile and 2 feet to **Woodhouse Landing**, $4\frac{1}{2}$ miles above the entrance. **Moradica Creek**, emptying into Lancaster Creek from northward, has a depth of 3 feet at the entrance and 2 feet to near the head. **Farnham Creek**, $3\frac{1}{2}$ miles northwestward of Whealton, has a depth of $2\frac{1}{2}$ feet at the entrance and for a distance of 3 miles above. All of these creeks are frequented by many motor boats and lighters carrying farm and wood products and general merchandise.

Bayport is a wharf and post office on the southwest side of the river opposite Whealton. On the northeast side 4 miles above Whealton is **Sharps Wharf**, and on the southwest side just westward of **Bowlers Rock** lighthouse is **Bowlers Wharf**. A draft of 8 feet can be taken to the latter from north-northwestward and 9 feet from east-southeastward.

Totuskey River, on the northeast side of Rappahannock River, 3 miles above **Bowlers Rock** lighthouse, has a depth of $4\frac{1}{2}$ feet across the bar at the entrance and $3\frac{1}{2}$ feet inside to a fixed bridge, $4\frac{1}{2}$ miles above the entrance. The deepest draft using it is 6 feet. The channel is narrow in places and difficult without local knowledge.

Wellford Wharf is on the northeast side of Rappahannock River 4 miles above **Bowlers Rock** lighthouse, and **Wares Wharf** is directly opposite on the southwest side.

Piscataway Creek, on the southwest side $2\frac{1}{2}$ miles below Tappahannock, has a depth of $3\frac{1}{2}$ feet across the flats at the entrance and 6 feet inside for a distance of 5 miles; the deepest draft using it is 6 feet. It is crossed by a drawbridge 4 miles above the entrance, having a single opening 28.6 feet wide. Directly opposite **Piscataway Creek** is **Little Carters Creek**, having a depth of $3\frac{1}{2}$ feet at the entrance and 2 feet for a distance of 3 miles.

Tappahannock is a village on the western side of Rappahannock River 39 miles above the entrance. The wharf with red warehouse on the end and a cannery with iron stack are prominent. There is a depth of 9 feet at the wharf.

Hoskins Creek, just below Tappahannock, has a depth of 2 feet across the bar at the entrance and deeper water inside for a considerable distance. It is crossed by a drawbridge $\frac{5}{8}$ mile above the entrance. There are numerous wharves and landings between Tappahannock and Fredericksburg, some of them being post offices, but no villages except Port Royal. The most important landings are **Naylors** and **Leedstown**, $2\frac{3}{4}$ and 15 miles, respectively, above Tappahannock.

Cat Point Creek, on the northeast side $2\frac{1}{2}$ miles above Tappahannock, has a depth of about 5 feet across the bar at the entrance and deeper water inside for 7 miles. The deepest draft using it is 6 feet. A drawbridge crosses the creek just inside the entrance.

Mount Landing Creek, on the southwest side 2 miles above Tappahannock, has a depth of $1\frac{1}{2}$ feet across the flats at the entrance and deeper water inside for $3\frac{1}{2}$ miles.

Occupacia Creek, on the western side 7 miles above Tappahannock, has a depth of 4 feet across the bar at the entrance and for $5\frac{3}{4}$ miles above in the main branch. The eastern branch has a depth of 2 feet to a fixed bridge $1\frac{1}{4}$ miles above its entrance. There are no wharves on either branch. The creeks emptying into Rappahannock River above Occupacia Creek are all shoal and of little interest to navigation.

Port Royal is a village on the southwest side of Rappahannock River 70 miles above the entrance. **Port Conway** is a village opposite Port Royal.

Newton Rock, on the southwest side 2 miles below the wharves of Fredericksburg, is bare at a little below high water. It lies 50 feet from the high-water shore line and the best water leads 100 feet outside of it.

Fredericksburg, a city at the head of navigation on Rappahannock River, has some trade by water, carried mostly in the regular steamers and in barges of 8 to 9 feet draft. Steamer navigation terminates at the wharves at the southern end of the city, though small boats can go about 1 mile farther. The river is crossed by two fixed bridges just above the wharves. Anchorage room is limited and vessels generally make fast to the wharves.

Anchorage.—Good anchorages for deep-draft vessels will be found in the mouth of the river southward or westward of Mosquito Point. Vessels can anchor anywhere in the channel of the river where the bottom is soft and the depth suitable. Carter and Urbana Creeks are extensively used as harbors for small craft.

Pilots.—Pilotage is not compulsory for Rappahannock River. Strangers bound up the river can obtain a pilot at Carter Creek, Urbana, or Tappahannock, and unless of light draft should not go above the latter place without one. Pilots for the upper part of the river can also be found at Port Royal.

Supplies.—Gasoline and provisions can be obtained at Irvington, Weems, Urbana, Tappahannock, Port Royal, Port Conway, and Fredericksburg, and there are stores at many of the other landings where some supplies are obtainable. Artesian water can be had at

or near the wharves in Carter Creek, at Urbana, Tappahannock, Fredericksburg, and several other landings. Coal can be obtained at Fredericksburg and in limited quantities from the fish factories in Carter Creek.

Repairs to hulls of vessels up to 200 tons, 148 feet length and 8 feet draft, can be made in Carter Creek, and to boats of 50 feet length and 5 feet draft in Urbana Creek. There are machine shops at both places and at Fredericksburg, where ordinary repairs to machinery can be made. Railways for hauling out small motor boats can be found in Mill and Lockley Creeks, Eastern Branch of Corrotoman River, and at Fredericksburg.

Ice, during severe winters, closes the river nearly to its mouth, but during ordinary winters the channels are usually kept open by the regular steamers. Ice sufficient to interfere with navigation of small craft will usually be met with in January and February and is most often found above Port Royal.

Freshets occur during the spring and fall, but are of short duration, and are not ordinarily dangerous to shipping. The highest water level on record was 32.8 feet above mean low water at Fredericksburg, but usual height due to freshets is not over 9 to 12 feet, and only occasionally rises above the wharves. The effect on the water level due to freshets decreases rapidly below Fredericksburg, and is ordinarily negligible below Farleyvale Reach, 11 miles below. The water is usually fresh above Port Royal, but is not suitable for use in boilers.

Tides.—The mean rise and fall of the tides at the mouth of the river is 1.2 feet; at Tappahannock, 1.6 feet; and at Fredericksburg, 2.8 feet. It is high water at the mouth of the river 1 hour 36 minutes after high water at Old Point Comfort, and at Tappahannock 2 hours 56 minutes later than at the mouth of the river.

Currents.—The currents follow the general direction of the channel. In the upper reaches of the river the velocities of the currents and the times of slack water vary to a considerable extent, due principally to freshets, but also to some extent to winds; they vary in a similar manner in the lower part of the river, but to a much less extent.

Abreast Windmill Point, at the mouth of the river, slack water before the flood occurs about 2 hours 40 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 1 hour before the time of high water at Old Point Comfort), and slack water before the ebb occurs about 2 hours 40 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 45 minutes before time of low water at Old Point Comfort).

At Tappahannock slack water before the flood occurs about 3 hours 15 minutes after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 45 minutes after time of high water at Old Point Comfort), and slack water before the ebb occurs about 3 hours 15 minutes after the time when the current turns southeast at Chesapeake Bay entrance (or approximately 40 minutes after time of low water at Old Point Comfort). The observed velocity of the current at strength of ebb was 1 knot and at strength of flood was 0.9 knot.

DIRECTIONS, RAPPAHANNOCK RIVER.

The channel from the mouth to Tappahannock is comparatively straight, gradually decreases in width, and leads between shoals which make out from both banks. The principal dangers are marked by buoys and lights. Strangers should have no trouble in taking a draft of 10 feet to Tappahannock by day with the aid of the chart. Above Tappahannock the river is narrow and crooked and requires local knowledge. Rocks occur in places on both sides of the channel for a distance of 4 miles below Fredericksburg, and the shores should be given a good berth. Strangers can safely carry a draft of 6 feet to Fredericksburg with the aid of the chart, but with a deeper draft are advised to take a pilot at Tappahannock.

The approach to Rappahannock River leads between Rappahannock Spit on the north and Stingray Point Shoal on the south. The shores on both sides at the entrance are wooded, and the most prominent landmarks are Windmill Point and Stingray Point lighthouses, both white houses on piles.

Rappahannock Spit, extending $4\frac{3}{8}$ miles east-southeastward from Windmill Point, is marked by Windmill Point lighthouse near the center, and a black gas buoy at the outer end. A red and black bell buoy $\frac{3}{8}$ mile west-northwestward of the gas buoy marks the wreck of the *Katahdin*. Vessels of 10 feet draft can cross the spit anywhere between the lighthouse and the gas buoy, and boats of 6 feet draft for a distance of 1 mile west-northwestward of the lighthouse. Rappahannock Spit is entirely within the area of possible fish traps; strangers should not cross it at night and should proceed with caution in the daytime.

The eastern limit of fish traps in the vicinity of Rappahannock River entrance is a line drawn from Smith Point lighthouse to Rappahannock Spit gas buoy, thence to buoy No. 11 south-southeastward of Wolf Trap lighthouse, and they are prohibited in water exceeding 45 feet in depth. The outer limit is marked by a line of black and white horizontally striped buoys.

Entering from southward.—Vessels should keep outside the line of buoys marking the eastern limit of fish traps, until $2\frac{5}{8}$ miles southward of Rappahannock Spit gas buoy and up to fish trap buoy "3 W"; the lighthouse will bear 328° true (NNW. $\frac{3}{8}$ W. mag.), distant $4\frac{1}{8}$ miles. Then steer 314° true (NW. $\frac{3}{8}$ N. mag.) for $3\frac{3}{4}$ miles to a position 1 mile south-southwestward of Windmill Point lighthouse. Then steer 279° true (WNW. $\frac{3}{4}$ W. mag.) for $5\frac{3}{8}$ miles, passing $\frac{3}{8}$ mile northward of Sturgeon Creek Shoal light, to a position $\frac{3}{8}$ mile southward of the red buoy off Mosquito Point.

Entering from northward.—Keep outside the line of buoys marking the outer limit of fish traps until down to Rappahannock Spit gas buoy. Passing eastward and $\frac{1}{2}$ mile southward of this, a 279° true (WNW. $\frac{3}{4}$ W. mag.) course for 8 miles will lead 1 mile southward of Windmill Point lighthouse, $\frac{3}{8}$ mile northward of Sturgeon Creek Shoal light, and to a position $\frac{3}{8}$ mile southward of the red buoy off Mosquito Point.

Mosquito Point to Tarpley Point.—From a position $\frac{3}{8}$ mile southward of the red buoy off Mosquito Point, steer 299° true (NW. $\frac{7}{8}$ W. mag.) for $4\frac{5}{8}$ miles, to a position 1 mile southward of the light at the entrance to Carter Creek and $1\frac{3}{8}$ miles north-northwestward of

Grey Point. Then steer 266° true (W. $\frac{1}{8}$ N. mag.) for $3\frac{1}{8}$ miles to a position $\frac{1}{4}$ mile south-southwestward of the red buoy off Tolls Point. From here a 302° true (NW. $\frac{5}{8}$ W. mag.) course for $2\frac{3}{8}$ miles will lead to a position $\frac{7}{8}$ mile northeastward of Urbana Creek outer light, and with the outer and inner lights in range, and then a 346° true (N. $\frac{3}{4}$ W. mag.) course for $4\frac{1}{2}$ miles will lead to a position $\frac{1}{2}$ mile eastward of Smoky Point buoy No. 1A. From here steer 317° true (NW. $\frac{5}{8}$ N. mag.) for 3 miles to a position 250 yards northeastward of a black buoy, and then steer 293° true (NW. by W. $\frac{1}{2}$ W. mag.) for $2\frac{1}{4}$ miles to a position 200 yards southwestward of Tarpley Point Shoal buoy.

Tarpley Point to Tappahannock.—The channel is narrow above Tarpley Point and strangers must depend upon the buoys and lights. The current has considerable strength at times and care must be taken not to be set off the courses by it.

From Tarpley Point buoy steer 319° true (NW. $\frac{7}{8}$ N. mag.) for $1\frac{1}{4}$ miles to a position 100 yards northeastward of the light off Jones Point, then head for Bowlers Rock lighthouse on a 309° true (NW. mag.) course until $\frac{1}{2}$ mile from it, being guided by the buoys. Pass 200 yards northeastward of the lighthouse and steer 326° true (NNW. $\frac{1}{2}$ W. mag.) for $2\frac{1}{4}$ miles to the northerly black buoy off Eubank, then steer 329° true (NNW. $\frac{1}{4}$ W. mag.) for $1\frac{3}{8}$ miles to a position $\frac{3}{8}$ mile west-southwestward of Accaceek Point and $\frac{1}{2}$ mile south-southwestward of Wellfords Wharf. From here steer 340° true (N. by W. $\frac{1}{4}$ W. mag.), passing $\frac{1}{4}$ mile off the wharf, and continue $\frac{3}{4}$ mile beyond until Ross Rock light bears 314° true (NW. $\frac{3}{8}$ N. mag.), distant $\frac{5}{8}$ mile. Then steer 308° true (NW. $\frac{1}{8}$ W. mag.) for $2\frac{3}{4}$ miles to the black buoy off Jones Point, passing 150 yards southwestward of the light, and after passing the buoy, head for the wharf at Tappahannock. Anchorage can be had in 13 to 17 feet anywhere in the channel between the wharf and the red buoy 1 mile east-southeastward.

RAPPAHANNOCK RIVER TO GREAT WICOMICO RIVER.

The western shore of Chesapeake Bay between Rappahannock River and Great Wicomico River is generally low and presents no prominent features. It is indented by numerous creeks and by Great Wicomico River. The creeks have numerous small villages and landings, but no large towns. Fish factories are located on most of them, and they are frequented by fish steamers of 8 to 12 feet draft and by many smaller craft engaged in the oystering and fishing industry. Steamers from Baltimore make regular trips to the principal landings between Great Wicomico River and Dymer Creek.

The outer limit of fish traps is a line joining Smith Point lighthouse and Rappahannock Spit bell buoy, and in water not exceeding 45 feet in depth. The outer limit is marked by a line of black and white horizontally striped buoys. Inside this limit, fish traps are numerous in season, but are prohibited along the regular navigable channels and at a greater distance from shore in the tributaries than one-third their width between shores. On account of the fish traps, strangers should not attempt to enter at night. Local vessels approaching the creeks from southward usually pass a little eastward of Windmill Point lighthouse, and keep outside the 18-foot

curve until off the entrance, and when approaching from northward keep outside the 12-foot curve. The mean rise and fall of tides in all of the tributaries is about 1.1 feet. Rappahannock Spit is described under Rappahannock River.

Fleets Bay, just northward of the entrance to Rappahannock River, forms the approach to Little Bay and Tabbs, Dyer, and Indian Creeks.

Little Bay and **Antipoison Creek**, emptying into Fleets Bay from southward, have a depth of 8 feet in a narrow channel for $2\frac{1}{2}$ miles above the entrance. A prominent shoal in Little Bay is marked by a buoy, and otherwise the chart is the guide. The creeks are frequented only by small local boats. There is an ice plant on the north shore of Antipoison Creek.

Tabbs Creek has a depth of 12 feet in the entrance and 7 feet to near the head. It is unmarked and frequented only by small craft.

Dyer Creek has been improved by dredging a channel to a depth of 15 feet and width of 200 feet in the approach through Fleets Bay, and has a natural channel 15 feet deep for 1 mile above the mouth and 8 feet to near the head. The dredged channel is marked by a red buoy and a light on the north side, and the entrance to the creek by a light on each side. Fish steamers drawing 12 feet are the deepest draft entering.

Ocran, a village on the south side of Dyer Creek $\frac{5}{8}$ mile above the entrance, is the principal landing, and a fish factory here is the most prominent mark in the vicinity. Gasoline, provisions, and water are obtainable, and coal in limited quantities from the fish factory. There is a railway in the creek capable of hauling out boats of 40 feet length and 4 feet draft.

Approaching **Dyer Creek** entrance, give the outer light a berth of over $\frac{1}{4}$ mile when eastward of it, and approach the light on a west-northwesterly course. Pass 50 to 100 yards southward of buoy No. 2, 60 yards southward of the outer light, and steer 300° true (NW. $\frac{7}{8}$ W. mag.) for $\frac{1}{4}$ mile, heading for the fish factory at Ocran. Then steer 317° true (NW. $\frac{3}{4}$ N. mag.) for the lights at the entrance; pass 50 yards or more southward of the red structure and 50 to not over 150 yards northward of the black one. Above the entrance the mid-channel is clear, but the points should be given a good berth. Approaching **Ocran Wharf** pass northward of the end of a shoal eastward of the wharf, which is sometimes marked by a private aid.

Indian Creek has a depth of 10 feet to **Kilmarnock Landing** and 6 feet to near the head. The principal landings are **Byrdton**, on the northeast side 1 mile above the entrance, and **Grace Point** and **Kilmarnock Landing**, on the southwest side 2 and $2\frac{1}{2}$ miles, respectively, above the entrance; the latter is at the foot of a road leading to the village of **Kilmarnock**. There are fish factories at Byrdton and Kilmarnock Landing. Gasoline, provisions, and water are obtainable at the latter. There are two lights on the north side at the entrance between the shoals, and a small private beacon, lighted during the fishing season, to mark the end of the shoal on the northeast side west of Henrys Creek.

To enter **Indian Creek**, keep southward of the shoals with depths less than 18 feet lying eastward of the outer light, and steer for the fish factory at Byrdton open southward of the outer light, course

305° true (NW. $\frac{3}{8}$ W. mag.). Pass 75 yards southward of the outer light and the inner light $\frac{1}{2}$ mile above it, and continue the course for the fish factory until inside the entrance. Pass 75 yards southward of the private beacon lying $\frac{1}{4}$ mile southeastward of Byrdton and 25 yards southward of a private aid westward of Bells Creek, above which the mid-channel is clear to Kilmarnock Landing, but the points should be given a good berth.

Dividing Creek has its entrance between shoals $7\frac{1}{4}$ miles 343° true (N. by W. mag.) from Windmill Point lighthouse. It has a depth of 12 feet to **Hardings** and **Harveys Wharves**, $1\frac{3}{4}$ miles above **Hughletts Point** at the entrance, and 6 feet for a farther distance of $\frac{3}{4}$ mile. The channel is marked by lights and buoys from the entrance between the shoals up to Prentice Creek and by bush stakes on the ends of the prominent shoals above that point. Prominent white fish factories are located on the point on the south side of Prentice Creek, $\frac{1}{4}$ mile above its entrance, and on the north side of the north point of Prentice Creek, and are visible from outside. There is a beacon on the south side at the entrance of **Prentice Creek**. Gasoline, provisions, water, and coal in limited quantities are obtainable.

The best water can be taken to the entrance of **Dividing Creek** by keeping Windmill Point lighthouse astern on a 345° true (N. $\frac{7}{8}$ W. mag.) course, with **Dividing Creek** light a little on the port bow; this course leads through an area of possible fish traps. But a depth of 10 feet can be taken to the entrance by approaching **Dividing Creek** light on any bearing between 264° true (W. mag.) and 343° true (N. by W. mag.). In entering, pass eastward and close northward of **Dividing Creek** light and 350 yards southward of a lighted beacon $\frac{5}{8}$ mile northwestward of it. Then steer northwestward into the creek, passing northwestward of the light on the south side at the entrance and southward of a red buoy. When inside the creek follow a general mid-channel course, keeping outside the bush stakes which mark the ends of the shoals.

GREAT WICOMICO RIVER (CHART 534),

6 miles southwestward of Smith Point lighthouse, is a good and convenient harbor and is extensively used by small vessels. It is also frequented by fish steamers, the regular passenger steamers, and schooners and barges carrying wood products. The draft of vessels entering it does not ordinarily exceed 12 feet. It has a depth of 18 feet for $5\frac{3}{4}$ miles above Great Wicomico River lighthouse, 10 feet for $2\frac{1}{2}$ miles farther to abreast Sampson Wharf, and is navigable for small craft for a farther distance of $2\frac{1}{2}$ miles. Vessels load with wood products as far up as Sampsons Wharf, cargoes being brought from above by lighters.

The channel is marked by lights and buoys to **Rogues Point**, $4\frac{1}{4}$ miles above Wicomico River lighthouse. The principal landings on the main channel of Great Wicomico River are **Mila**, **Blackwells**, **Tipers**, and **Sampsons Wharves**. The principal marks for the entrance are **Great Wicomico River** lighthouse (white house on piles) and a group of buildings, a church spire and an iron stack at **Fleeton**, on **Fleets Point**. The shoals outside the entrance are generally covered by fish stakes.

Ingrams Bay and **Mill Creek**, west-southwestward of Great Wicomico River lighthouse, have a depth of 12 feet for 3 miles above the lighthouse and 8 feet for a farther distance of 1 mile. The channel is narrow and unmarked and strangers should not enter without a pilot.

Cockrells Creek, on the north side, just inside the entrance of the river, has numerous fish factories and is the center of a large trade by water. **Fleeton**, **Fairport**, and **Reedville** are villages on the creek, and there are several other landings. All kinds of supplies are obtainable, and there is a railway for hauling out boats of 50 feet length and 5 feet draft. Some ship chandlery can be obtained at Reedville, as well as water, gasoline, and coal in limited quantities; there are depths of 8 to 15 feet at the wharves. Fleet Point light is the principal guide to the entrance.

The other tributaries of Great Wicomico River are used by small local boats, but are unmarked and of little interest to general navigation.

Anchorage.—Vessels entering Great Wicomico River for shelter usually anchor off and in the mouth of Cockrells Creek in 15 to 20 feet. Motor boats usually anchor in the creek. Cockrells Creek is also considerably used as a secure harbor from ice.

Ice does not close the river to navigation except in severe winters, and then only for short periods.

Tides.—The mean rise and fall of tides is 1.1 feet at the entrance of Great Wicomico River.

Directions, Great Wicomico River.—Fish traps will usually be found on the shoals near and off the entrance to Great Wicomico River, and strangers entering at night should follow the deepest water and proceed with caution.

The best water will be taken into the entrance on a 287° true (WNW. mag.) course, passing 300 yards north-northeastward of Dammeron Marsh Shoal buoy, 350 yards southward of Great Wicomico River lighthouse, and 150 yards southward of Fleet Point buoy.

If bound above Cockrells Creek, from a position 150 yards southwestward of Fleet Point buoy, steer 326° true (NNW. ½ W. mag.) for Sandy Point light (black structure); round it at a distance of 100 yards or more and steer northwestward for Haynies Point light (red structure); round this light at a distance of 100 yards or more and be guided by the chart. A general mid-channel course is the best, but unmarked shoals extend for a considerable distance offshore in places.

To enter Cockrells Creek pass 300 yards westward of Fleet Point light and steer 34° true (NE. ½ N. mag.), passing 150 yards off the wharf on the north side of Fleet Point. Then pass about 75 yards off the wharf on the west bank and leave the wharf on the next point on the west bank 150 yards on the port hand. Anchor in the channel anywhere below the fish factory on the west bank at Fairport.

POTOMAC RIVER,

on the western side of Chesapeake Bay, 66 miles above the entrance and 84 miles below Baltimore forms the boundary between the States of Maryland and Virginia, and is the approach to the cities of Alexandria and Washington, and many villages and landings. It is navi-

gable by vessels to Washington, 95 miles above the entrance, and by small unmasted vessels for about 3 miles above to Little Falls. The vessels using the Potomac River are occasional coasting and foreign vessels bound to Alexandria and Washington, the regular steamers from Washington, Baltimore, and Norfolk to the landings, and a large number of small craft engaged in oystering and fishing.

The channel is good for a depth of 18 to 22 feet, which is found between the lumps when crossing Kettle Bottom Shoals. There is a narrow channel with a navigable depth of 23 to 24 feet through Kettle Bottom Shoals along the north bank. The dredged cuts between Maryland Point and Douglass Point and through Mattawoman Shoals are about 200 feet wide, with a depth of 24 feet. A draft of 22 feet has been taken up the river to Washington, but this is exceptional; 18 to 20 feet is about the ordinary deepest draft.

The lower Potomac, from Dahlgren to the mouth, is used extensively by the Navy as a firing range and torpedo speed trial course. Buoys and barges will be found anchored in various localities, of which notice will be given in the Notices to Mariners.

The firing range of the United States Naval Proving Ground, Dahlgren, Va., involves the entire portion of the Potomac River below a line joining Persimmon Point, Va., with the entrance of Popes Creek, Md., and constitutes a danger zone. Firing over this range will normally take place between the hours of 9 a. m. and 4 p. m. on all days except Sunday.

Any vessel propelled by mechanical power at a speed greater than 5 miles per hour may proceed directly through the danger zone without restriction, except when especially notified to the contrary.

When firing is in progress, all vessels in or near the danger zone will be duly met by representatives of the inspector of ordnance in charge, suitably warned, and given the necessary instructions and orders to insure their safety. During the period from February 15 to May 15 the area between Smith Point and Ragged Point, the authorized fish-stake line, and the Virginia shore will not be fired into.

These regulations shall be enforced by the inspector of ordnance in charge, U. S. Naval Proving Ground, through such officers, enlisted men, and employees at the U. S. Naval Proving Ground as may be designated, including always the commanding officer of the range patrol, using all agencies as Government vessels, seaplanes, and other suitable equipment as may be necessary. These agencies will fly or expose a square red flag in clearing a danger zone.

Little Wicomico River, entering the south side of Potomac River $\frac{7}{8}$ mile northwestward of Smith Point, is nearly dry at low water at the entrance, and not more than 3 feet can be taken across the bar under the most favorable conditions of high water and a smooth sea. The entrance is also subject to change. The depths in the river are said to range from 6 to 15 feet. There is no traffic to and from the river, shipments being made by way of Great Wicomico River. **Sunnybank** is a post office on the south side of the river, 1 mile above the entrance.

Hack Creek, Cubitt Creek, Hull Creek, Presley Creek, and Cod Creek, on the south side of Potomac River between Little Wicomico and Coan Rivers, are not used. The entrances are often dry at low water.

Coan River is on the south side of Potomac River, 14 miles above Smith Point lighthouse and $6\frac{1}{2}$ miles 251° true (WSW. $\frac{7}{8}$ W. mag.) from Point Lookout lighthouse. Steamers drawing 9 feet or a little over make regular trips to the landings. The entrance is marked by aids, some of which are lighted, and is easy of access. Above the entrance, pile beacons with slatted day marks or bush stakes are maintained by the steamboat company in a depth of about 6 feet on the principal shoals as far as the landings, but some difficulty may be experienced in taking a greater draft than 8 feet to Coan and Bundick. The mean rise and fall of tides is 1.4 feet.

The landings are **Lewisetta, Cowart, Walnut Point, Lake, Coan, and Bundick**, and these landings are post offices. The bight on the south side of Walnut Point is used as an anchorage by small craft. There are stores at the landings, and artesian water and gasoline can be had at some of them.

Kingscote Creek, the northern branch on the west side of Coan River, is navigable for vessels of 8 feet draft for a distance of $\frac{3}{4}$ mile above the wharf at Lewisetta. Shoals extend halfway across the entrance from the west side northward of Cowarts Wharf and the channel is further narrowed by a shoal extending southwestward from the next point above the Lewisetta Wharf. Above these shoals the mid-channel is clear.

The **Glebe**, the principal tributary on the west side of Coan River, is navigable for vessels of 9 feet draft for a distance of $1\frac{1}{2}$ miles above Cowarts Wharf; the mid-channel is clear, except for a shoal which extends well off from the point on the south side $\frac{3}{4}$ mile above Cowarts Wharf. The south arm at the head of the Glebe has a channel depth of 8 feet for a distance of $\frac{1}{2}$ mile above the entrance. Gasoline and water can be obtained at Cowarts Wharf, and there is a marine railway with a capacity of about 40 tons.

Directions, Coan River.—A channel 500 yards wide is kept clear of fish stakes in the approach to Coan River; passing $\frac{5}{8}$ mile southeastward of Coan River gas and bell buoy, the center line of this channel trends 231° true (SW. by W. $\frac{1}{8}$ W. mag.) to a position 250 yards northwestward of Coan River light (black pile structure). Pass 100 yards westward of Coan River light, steer 169° true (S. $\frac{1}{2}$ E. mag.) and pass eastward and southward of Travis Point Spit light, rounding it at a distance of 200 to 300 feet. Then steer 271° true (W. $\frac{5}{8}$ N. mag.) for Cowarts Wharf, passing midway between the beacons southward of Lewisetta, from which point the channel is clear to the wharves at Lewisetta and Cowarts.

To continue up Coan River, pass 300 to 400 feet eastward of the beacon off the entrance of the Glebe, about 200 feet eastward of the next beacon southward, about 150 feet eastward of the beacon westward of Walnut Point, and 200 feet eastward of the beacon, southward of Walnut Point. Then keep about mid-river giving the beacons a berth of about 300 feet, and pass about midway between the beacons southeastward of Lake Landing on a southerly course. Above Lake Landing favor slightly the west bank until approaching Coan Wharf. A draft of 6 feet can be taken about $\frac{3}{4}$ mile above Bundick Wharf to the old wharf on the west side, and 3 feet about $\frac{1}{2}$ mile farther to the small landing at the head of the river; the points should be given a good berth.

Judith Sound, just northward of the entrance to Coan River, is shallow, and motor boats bound northward from Coan River must go outside of Hog Island.

Yeocomico River is on the southwest side of Potomac River, 17 miles above Smith Point lighthouse and 9 miles 269° true ($W. \frac{1}{2} N.$ mag.) from Point Lookout lighthouse. It has a depth of 13 feet in the entrance and 9 feet to **Lodge Landing** on **South Yeocomico River** and to **Kinsale** on **West Yeocomico River**. Steamers between Baltimore and Washington drawing $9\frac{1}{2}$ feet make regular trips to several landings in the river. **Lynch Point light**, on the north side, is the principal guide to the entrance. A light and a red buoy mark the entrance to West and South Yeocomico Rivers, and single pile beacons with slatted daymarks are maintained in a depth of about 6 feet to mark the most dangerous shoals in these branches. The mean rise and fall of tides is 1.4 feet.

The landings in Yeocomico River are **Kinsale**, **Mundy Point**, and **Lodge**, and there is a post office at each. **Kinsale** is the principal village, and gasoline, provisions, and water are obtainable there. Some supplies can also be obtained at the other landings. There is a marine railway of 40 tons capacity on South Yeocomico River, 1 mile south of Mundy Point.

White Point Creek, the northwestern branch of Yeocomico River, has a depth of 9 feet for 1 mile above the entrance. **White Point** is a landing on its southwest side. A marine railway with a capacity of 20 tons is on the south side of Mill Branch. To enter, bring **Barn Point light** astern on a northwesterly course, heading southward of the end of White Point, and pass about 150 yards off the northeast bank southeastward of White Point. The mid-channel is then clear, except for a shoal which extends northeastward to mid-river from the point on the north side of Mill Branch.

A channel 650 yards wide is kept clear of fish stakes in the entrance of Yeocomico River. From a position nearly 2 miles 68° true (ENE. $\frac{5}{8}$ E. mag.) from **Lynch Point light**, the center line of this channel trends 244° true (WSW. $\frac{1}{4}$ W. mag.) to a position 325 yards southward of **Lynch Point light**, and then 261° true ($W. \frac{1}{4}$ S. mag.) to a position 325 yards northward of **Barn Point light**. Pass 200 yards northward and westward of **Barn Point light**, steer southward for the red buoy westward of **Barn Point**, and pass eastward of it.

To enter **West Yeocomico River**, pass between the red buoy and the beacon southwestward of it and steer westward to **Kinsale**, following a general mid-channel course and keeping outside the beacons which mark the ends of the shoals. A depth of 9 feet can be taken alongside the wharf at **Kinsale**, or anchorage may be had in a depth of 10 feet in the mouth of **Hampton Hall Branch**, just below the wharf. There is a draw bridge just above **Kinsale**.

To enter **South Yeocomico River**, pass eastward of the red buoy westward of **Barn Point** and steer southward, passing 100 yards off **Mundy Point wharves**, 70 yards eastward of the beacon just southward of them, and follow a general mid-channel course to **Lodge Landing**, giving the points a good berth and keeping outside the beacons which mark the ends of the shoals. There is a depth of 3 feet for $\frac{3}{4}$ mile above **Lodge Landing**.

Cornfield Harbor, just inside of Point Lookout, is sheltered from northerly and northeasterly winds and vessels bound up and down

the bay frequently use it as an anchorage for the night. The shoaling is gradual and the lead a good guide except off **Cornfield Point** and at the south end of the shoal (marked by a red buoy) extending $\frac{3}{4}$ mile southward from **Point Lookout**, where it is abrupt and the bottom hard sand. The only outlying danger is a shoal with 6 feet over it and 15 to 20 feet around it, lying 650 yards west-northwestward of **Point Lookout** lighthouse, and marked by a red buoy. There is a short wharf with 10 feet at its end just westward of the lighthouse. **Point Lookout** and **Cornfield Point** are post offices. **Point Lookout Creek** has a depth of about 2 feet in its entrance.

The small creeks between **Cornfield Point** and **Smith Creek** are shoal and little used; most of them can not be entered at low water.

Smith Creek, on the north side of **Potomac River**, $5\frac{1}{2}$ miles northwestward of **Point Lookout**, has a depth of 10 feet across the bar at the entrance and 17 feet inside to the junction of the northern and eastern branches. Both branches have a depth of 12 feet for $\frac{3}{4}$ mile and 8 feet to near their heads. Steamers drawing $9\frac{1}{2}$ feet make regular trips to **Millers Wharf** (**Wynne** post office) in the creek, and many small boats make use of the creek as a harbor. There is a store at **Millers Wharf**, where gasoline and some provisions are obtainable.

The channel at the entrance of **Smith Creek** is very narrow and difficult and is marked by lights and buoys. A channel 600 yards wide is kept clear of fish stakes, the center line of the channel trending 355° true (N. $\frac{1}{8}$ E. mag.) for $1\frac{3}{4}$ miles to a position 300 yards westward of the red buoy off the entrance. Pass 200 yards westward of the buoy and steer north-northeastward with the outer light (black structure) a little on the port bow. Pass about 200 yards southeastward and 100 feet northeastward of the outer light, and 150 feet southwestward of the red buoy and inner light. Above this point the mid-channel is clear, but a shoal extends 300 yards northwestward from the point $\frac{1}{4}$ mile southwestward of **Millers Wharf** and is marked by a red buoy.

St. Marys River, on the north side of **Potomac River**, 6 miles northwestward of **Point Lookout**, has a depth of 24 feet or more to **Priests Point**, 21 feet to **St. Marys**, and 8 feet to **Lynch Island**, distant $3\frac{1}{2}$, 6, and $8\frac{1}{2}$ miles, respectively, above the entrance. It is 2 miles wide at the entrance and has a channel width of $\frac{1}{2}$ to $\frac{3}{4}$ mile up to **Priests Point**, forming a secure harbor. It is the principal anchorage in the mouth of **Potomac River** for vessels seeking shelter in heavy gales. The mean rise and fall of tides is 1.7 feet.

A shoal extends $1\frac{1}{4}$ miles southeastward from **St. George Island** and is marked by a horizontally striped buoy, which is the principal guide to the entrance. There is a horizontally striped buoy $\frac{1}{2}$ mile south-southeastward of **Cherryfield Point**, but depths of 12 to 17 feet extend $\frac{1}{2}$ mile southeastward of it. **Priests Point** is marked by a large white building, and there is a light on the end of the shoal off the point. **Windmill Point** is a low yellow bluff, with a cluster of trees at the end; the shoal off the point is marked by a black buoy. **St. Marys Point** is marked by a low church spire visible above the trees and a monument on the end of the point.

The landings are **Bromes Wharf** (**St. Marys City** post office) and **Portobello**, on **St. Marys River**, and **Grayson Landing**, on the south side of **St. Inigoes Creek**, 1 mile above its mouth. Steamers drawing 10 feet make regular trips to all of them, and there is daily auto service

between St. Marys and Washington. Some provisions can be obtained at St. Marys.

Directions, St. Marys River.—The outer limit of the fish traps in the vicinity is defined by a line extending 301° true (NW. $\frac{3}{4}$ W. mag.) from Point Lookout Shoal buoy, passing $\frac{1}{4}$ mile off the south point of St. George Island, and continued $1\frac{1}{2}$ miles past that point; and then trending 312° true (NW. $\frac{1}{4}$ mag.) and passing $\frac{3}{8}$ mile off Piney Point lighthouse. Vessels should keep southward of these lines, especially at night. A channel 800 yards wide is kept clear of fish traps in St. Marys River, the center line of the channel trending 346° true (N. $\frac{3}{4}$ W. mag.) and passing $\frac{3}{4}$ mile westward of Kitts Point, $\frac{5}{8}$ mile eastward of the horizontally striped buoy lying southeastward of St. George Island, and $1\frac{1}{8}$ miles eastward of the island.

Passing $\frac{1}{4}$ mile or more southward and $\frac{1}{4}$ mile eastward of the horizontally striped buoy southeastward of St. George Island, steer 355° true (N. $\frac{1}{8}$ E. mag.) for Windmill Point; this course leads across an area of possible fish traps for a distance of 1 mile above the buoy. Pass 200 yards westward of Priests Point light, about the same distance eastward of the black buoy off Windmill Point, and round Windmill Point at a distance of at least $\frac{1}{4}$ mile. Pass 300 yards or more off Chancellor Point (on east bank $\frac{5}{8}$ mile above Windmill Point), and then keep near the middle of the river to the head, except abreast the shoal which extends 300 yards southwestward from Horseshoe Point, $\frac{3}{4}$ mile northwestward from St. Marys.

St. George Island is a long, low, sparsely wooded island on the west side of the entrance to St. Marys River, and the southwest side of St. George River. It is thickly settled, mostly by oystermen and fishermen, and is also used to a considerable extent as a summer resort. There is a post office and a landing (Adams Wharf) for small boats on the northeast side, where gasoline and provisions can be obtained. Pilots can also be obtained for any of the adjacent tributaries.

St. George River has a narrow, crooked channel with a depth of 10 feet for 4 miles. Shoals make out from many of the points. It is frequented by oystering and fishing boats during the entire year, and by many pleasure craft during the summer; 3 to 5 feet is the usual draft of boats frequenting it, though vessels of 8 to 10 feet draft sometimes load with wood products. The red and black horizontally striped buoy southeastward of Cherryfield Point is the only mark, and local knowledge is required to carry the best water above the entrance. A channel 600 yards wide is kept clear of fish traps in the entrance, the north edge of the channel trending 309° true (NW. mag.) to the horizontally striped buoy.

St. George River can be entered with a depth of 3 feet at low water through the Straits, at the northwest end of St. George Island. Headroom is limited to 8 feet by a bridge crossing the Straits. There is a post office (Piney Point) on the southwest side of St. George River just above the Straits, and gasoline can be obtained.

Piney Point is marked by Piney Point lighthouse (white tower). There is a steamboat wharf with a depth of 10 feet $\frac{1}{4}$ mile northeastward of the end of the point, and gasoline and provisions may be obtained. There is a summer hotel here. The point should be given a berth of 300 yards to avoid a shoal, bare at low water, ex-

tending southward from it, and to avoid fish stakes just eastward of the point.

Ragged Point, on the southwest side of Potomac River, 15 miles above Point Lookout, has shoals extending off it in all directions, the northeast edge of the shoals being marked by **Ragged Point lighthouse** (white house on piles). Deep-draft vessels should give the lighthouse a berth of $\frac{1}{4}$ mile or more.

Machodoc River, $2\frac{1}{2}$ miles westward of Ragged Point lighthouse and 5 miles 127° true (SE. $\frac{1}{8}$ E. mag.) from Blackstone Island lighthouse, has a depth of 12 feet for $1\frac{1}{2}$ miles, 8 feet in a dredged channel through the narrows 2 miles above the entrance, and 6 feet above to near the head of navigation. Steamers from Washington drawing 6 feet make regular trips to **Edgewater Wharf**, which is the principal landing. Gasoline can be obtained from a store near Edgewater Wharf and water from an artesian well. The entrance is narrow and obstructed by shoals extending from either side and is marked by a light and buoys. A cable crosses the river from Barnes Point to a point south of Crab Point.

To enter **Machodoc River**, steer for the light at the entrance on about a south (mag.) course; pass westward and southward of the light, and midway between the two buoys southeastward of it. Follow a general mid-channel course to the narrows, and pass through the narrows, following the red buoys on a 208° true (SW. by S. mag.) course, passing 75 yards off the point on the west side and 100 yards off the point on the east side. Pass close to the end of wharf and follow a general mid-channel course to Parham Point.

Nomini Bay, on the south side of Potomac River, 22 miles above the entrance and $3\frac{1}{2}$ miles 165° true (S. $\frac{3}{4}$ E. mag.) from Blackstone Island lighthouse, has depths of 15 to 19 feet and forms the approach to Nomini Creek and Currioman Bay. The shoaling is abrupt on the east side and gradual on the west side.

Nomini Creek has been improved by dredging a channel 9 feet deep and 150 feet wide from the head of Nomini Bay to **Hickory Point**, 1 mile above, and by the construction of a jetty on the east side at the entrance. The creek has a natural depth of not less than 7 feet from the head of the dredged channel to Nomini, $2\frac{1}{2}$ miles above, 5 feet to a drawbridge 1 mile above Nomini, and 3 feet for a further distance of 1 mile.

The landings are **Beales**, **McGuire's**, and **Mount Holly**, on the southeast side, and **Deep Point** and **Nomini** on the west side. Mount Holly is a post office. Gasoline, provisions, and water are obtainable in several places. Steamers from Washington of 6 feet draft make regular trips to all of the landings, and there is an automobile ferry from McGuire's to Leonardtown, Md. A center pier drawbridge, each opening 60 feet wide, with a headroom of 5 feet at high water when closed, crosses the creek at Nomini. The mean rise and fall of tides is 1.8 feet.

The dredged channel into Nomini Creek is marked by buoys and lights and by bush stakes maintained by the steamboat company. To enter give the shores of Nomini Bay a berth of $\frac{1}{2}$ mile and head for the outer end of the jetty. Pass 100 yards westward of it, and steer 152° true (SSE. mag.) in the dredged channel, following the buoys, and passing 100 feet westward of White Point light and 250 feet westward of Ice House Point light. Bring the latter light

astern on a 181° true (S. $\frac{5}{8}$ W. mag.) course, following the dredged channel, and passing eastward of the red buoy at its south end and intermediate private aids. From this point to Nomini the mid-channel is clear. Shoals make off from many of the points, and they should be given a good berth.

Currioman Bay, emptying into Nomini Bay from westward, has a depth of 8 feet at its entrance and 7 to 10 feet anywhere in mid-channel to near the head. It is separated from the river by a narrow, marshy spit, wooded in the center, and awash near its western end. **Currioman Wharf** is the principal landing and is used by steamers from Washington drawing 6 feet. The end of the shoal extending southeastward from **Elbow Point** is marked by buoys, and usually by a bush stake. To enter, pass 200 yards westward of the north end of the jetty at the head of Nomini Bay, steer southwestward for about 400 yards and then westward, passing southward of the buoys and bush stake marking the end of the shoal. When past the second buoy steer northwestward into the bay, favoring slightly the northeast side at the entrance, and then keep in mid-channel.

Piney Point, Herring, Blake, Poplar Hill, and Flood Creeks, between Piney Point and Bretons Bay are shoal and unimportant; 1 or 2 feet can be taken into most of them at low water, but they are little used.

Bretons Bay is on the north side of Potomac River, 2 miles eastward of Blackstone Island lighthouse, and is a favorite anchoring ground for yachts. Steamers drawing 10 feet make regular trips to the landing on the northeast side of Lovers Point (**Abell Wharf**) and to **Leonardtown** at the head. There is a depth of 13 feet or more for $3\frac{1}{2}$ miles above the entrance to Lovers Point light. The channel for this distance is marked by buoys and is easily followed, but care is required to follow the best water above this point at Leonardtown. The latter is reached through a dredged channel 170 feet wide and 10 feet deep, and there is a turning basin 300 feet wide off the wharf. Gasoline, ice, and provisions can be obtained at Leonardtown and gasoline at **Ewells Wharf**; the latter is inside the entrance of **Cooms Creek**, on the north side of Bretons Bay, 2 miles above the entrance. A channel with a depth of about 6 feet leads into the creek to the landing at **Ewells**. The entrance is narrow between shoal spits marked by stakes. There are marine railways with capacities of 80 tons each near the entrance to the creek. Leonardtown has daily auto bus communication with Washington. **Compton P. O.** is at the upper end of the west branch of Cooms Creek. The mean rise and fall of tides in Bretons Bay is 1.8 feet.

Directions, Bretons Bay.—A shoal with little depth extends $\frac{3}{4}$ mile southwestward from **Higgins Point**, on the east side at the entrance, and is marked by a lighted beacon. Passing $\frac{1}{4}$ mile northeastward of **Ragged Point** lighthouse, a 309° true (NW. mag.) course for 6 miles will lead southwestward of **Higgins Point** lighted beacon. Or, coming down the river, pass well southward of **Heron Island Shoal**, and from the horizontally striped buoy at its eastern end a 14° true (N. by E. $\frac{3}{4}$ E. mag.) course will lead westward of **Higgins Point** lighted beacon.

Passing 200 yards or more westward of **Higgins Point** lighted beacon, steer 14° true (N. by E. $\frac{3}{4}$ E. mag.) and keep near the middle of Bretons Bay. Give **Paw Paw Point**, on the north shore nearly 3

miles above the entrance, a berth of about $\frac{1}{4}$ mile. Pass midway between Lovers Point light and the point (end of shoal marked by bush) westward on a northerly course, and pass westward and northward of the light at a distance of about 100 yards until heading about 106° true (ESE. mag.). To go to Abell Wharf, approach it on a bearing westward of 185° true (S. by W. mag.).

To continue to Leonardtown pass 100 yards off the point on the south bank above Lovers Point, and steer 35° true (NE. $\frac{3}{8}$ N. mag.), following the dredged channel, with Buzzard Point light a little on the port bow, leaving a bush stake off the second point above Lovers Point 50 yards to starboard. Pass southeastward of the light, make the turn with a starboard helm following the bush stakes. Then steer 300° true (NW. $\frac{3}{4}$ W. mag.) in the dredged channel, heading about 75 feet outside the wharf at Leonardtown. This section of the cut is marked on both sides by bush stakes.

St. Clement Bay is on the north side of Potomac River, north-northeastward of Blackistone Island lighthouse. There are three entrances. The eastern or main entrance, between Heron Island Shoal and Newton Neck, is $\frac{1}{2}$ mile wide with a depth of 18 feet, and is easily followed by day; the middle entrance, between Heron Island Shoal and Blackistone Island, is narrow and crooked, is marked by beacons and buoys, and is easily followed in the daytime; the western entrance, called Dukeharts Channel, requires some local knowledge.

Steamers drawing 10 feet make regular trips to the landings at **Cobrums Wharf** and **Bayside Landing**, near the head of steamboat navigation 5 miles above the entrance of St. Clement Bay; the channel is easily followed. **Palmers**, on the south side of **St. Patrick Creek**, is a post office; the creek is navigable for motor boats. **Canoe Neck Creek** has a depth of 6 feet for about 1 mile. **Morris Point Landing** is just inside the creek. Gasoline, provisions, and water can be obtained, and there is communication by steamer with Washington. The mean rise and fall of tides in St. Clement Bay is 1.8 feet.

Directions, St. Clement Bay.—Passing $\frac{1}{4}$ mile northeastward of Ragged Point lighthouse, a 305° true (NW. $\frac{3}{8}$ W. mag.) course for 6 miles will lead northward of the horizontally striped buoy on the eastern end of Heron Island Shoal. Pass $\frac{1}{8}$ to $\frac{1}{4}$ mile northeastward of this buoy and continue the course for $1\frac{1}{2}$ miles to the buoy southwestward of Newtown Neck. Or coming down the river, to pass between Blackistone Island and Heron Island Shoal, pass southward and 100 yards eastward of the black buoy at the entrance, 100 yards eastward of Blackistone Island Shoal lighted beacon on a northwesterly course, 150 yards westward of Heron Island Bar beacon on a northerly course, and then port slowly to a 28° true (NE. by N. mag.) course, which should lead to the red buoy southwestward of Newtown Neck.

Pass 300 yards westward of the latter buoy and steer 354° true (N. mag.), giving Long Point a berth of over 300 yards. Then keep in mid-channel, giving the points a good berth. Pass 100 yards or more northeastward of Cedar Point light and steer for Cobrums Wharf, or follow a mid-channel course to Bayside Landing; the latter should be approached on a 7° true (N. by E. $\frac{1}{8}$ E. mag.) course to avoid shoals on either side.

Dukeharts Channel, leading into St. Clement Bay northward of Blackistone Island, is good for a depth of 7 feet, is used by the regular steamers drawing 6 feet and by motor boats, and is marked by buoys and usually by bush stakes. It should not be used by strangers except in small boats.

To enter Dukeharts Channel, pass southward and about $\frac{1}{4}$ mile eastward of buoy No. 6 and steer for a prominent white house at the mouth of Dukeharts Creek on a 23° true (NNE. $\frac{5}{8}$ E. mag.) course and pass 100 yards westward of a black buoy on the end of the shoal extending northwestward from Blackistone Island. Make a sharp turn around the buoy with a port helm, and head down a little northward of the middle of Blackistone Island until nearly up to buoy No. 4. Pass 100 yards southward of this buoy on an east-northeasterly course. To continue into St. Clement Bay, pass 300 yards northward of Blackistone Island on an easterly course, 50 yards northward of the black buoy at the eastern entrance of Dukeharts Channel, and about 200 yards northwestward of Heron Island Bar beacon.

Heron Island Shoal is an extensive shoal area entirely submerged at high water, and having an extensive area bare at low water. It is marked at the eastern end by a horizontally striped buoy.

Blackistone Island is sparsely wooded and is marked at the south end by **Blackistone Island lighthouse** (white dwelling). Shoals extend from it in all directions, the southern limit of the shoal area being marked by a red buoy.

Wicomico River, on the north side of Potomac River, 28 miles above Point Lookout, has a depth of 24 feet or more for $3\frac{1}{2}$ miles above Cobb Point Bar lighthouse, at the entrance, and 12 feet for a further distance of $1\frac{1}{2}$ miles. Above this point there are many detached shoals which render navigation difficult for boats of a greater draft than 5 feet, though with local knowledge a draft of 8 feet can be taken 8 miles above the entrance, and 3 feet to the head of navigation, 12 miles above the entrance. The river is characterized by spits, with little depth and terminating abruptly, which extend to mid-river in places; those near the entrance are marked by **Cobb Point Bar lighthouse** (white house on piles) and by several buoys. The mean rise and fall of tides is 1.9 feet.

Steamers drawing 10 feet make regular trips to **Rock Point** and **Bushwood** (Blackistone post office), and these are the principal landings. Gasoline and provisions are obtainable at Rock Point and Bushwood.

St. Catherine Sound, on the east side of Wicomico River, at the entrance, has depths of 5 to 9 feet through the middle, but there are extensive shoals close to the channel. A depth of $2\frac{1}{2}$ feet can be carried through it into Wicomico River. **River Springs** is a post office on the northeast side.

Neals Sound, on the west side of Wicomico River, southward of Rock Point, has a depth of 6 feet in the entrance and 7 to 11 feet inside, and forms a secure anchorage for motor boats. The entrance is obstructed by rocks close to the channel and a stranger should proceed with caution. The outlet into Potomac River, near the head, has a depth of about 1 foot at low water.

Chaptico Bay, on the east side of Wicomico River, $6\frac{1}{2}$ miles above the entrance, has a depth of 2 to 5 feet. It has no wharves and little business by water.

To enter **Wicomico River**, pass southward and eastward of the horizontally striped buoy at the entrance and $\frac{1}{4}$ mile eastward of Cobb Point Bar lighthouse, and steer 339° true (N. by W. $\frac{3}{8}$ W. mag.) for the church spire at Rock Point. Passing 150 yards westward of the red buoy on the end of the shoal extending westward from St. Margarets Island, vessels can steer for Rock Point Wharf, being careful to avoid a shoal extending eastward from the island on the west side and usually marked by a bush stake. Or from the red buoy a 30° true (NE. $\frac{3}{4}$ N. mag.) course can be steered for Bushwood Wharf. Or, if bound to points above, from the red buoy steer 10° true (N. by E. $\frac{3}{8}$ E. mag.) for the island on the end of White Point Bar to a position eastward of the black buoy on the end of the shoal extending eastward from Rock Point, and then steer 339° true (N. by W. $\frac{3}{8}$ W. mag.), being guided by the chart.

Pope Creek, on the southwest side of Potomac River, 4 miles below Colonial Beach, is bare at low water at the entrance.

Mattox Creek, 1 mile southward of Colonial Beach, has a depth of 6 feet in a narrow, crooked channel to **Wirts** and **Masseys Wharves**, 2 miles above the entrance, and 4 feet for a farther distance of 2 miles to a highway drawbridge. The entrance is marked by lights and buoys, but strangers seldom enter except in small boats. Steamers of 6 feet draft make regular trips to Wirts and Masseys Wharves, and motor boats and an occasional schooner carrying wood products go several miles farther. In entering, pass 100 yards westward of the lights and be guided by the chart and the buoys. The shoal extending eastward from **Paine Point** is usually marked by a bush stake.

Colonial Beach is a summer resort on the southwest side of Potomac River, 34 miles above the entrance and 61 miles below Washington. It is connected with Washington by steamer and with the railroad at Popes Creek by motor boat; 10 feet can be carried to the wharf from any position in mid-river. There are telephone and telegraph connections. Water, provisions, gasoline, and coal in limited quantities can be obtained, and there is a railway for motor boats in **Monroe Creek**.

Monroe Creek, having its entrance at the south end of Colonial Beach, is extensively used as an anchorage for boats; it has a depth of 6 feet in the entrance and 3 feet almost anywhere in the creek. Gasoline and provisions may be obtained. To enter, give the east and south shore of Colonial Beach a berth of over $\frac{1}{4}$ mile and approach the entrance on a northerly course about 500 feet from the west shore. Pass through the entrance close along the end of Gum Bar Point, head for a small clump of trees about 100 yards from the end of Dickinson Point, on the west side, until nearing the point, above which 3 feet can be carried anywhere.

Potomac Beach is a post office and landing on the south side of Potomac River southeastward of the mouth of Rosier Creek. Steamers drawing 6 feet make stops there. Gasoline and some provisions can be obtained.

Rosier Creek, 3 miles above Colonial Beach, has a depth of 4 feet in the entrance and 3 feet for 1 mile above. The best water in the ap-

proach leads close along the ends of the wharves at Potomac Beach and follows the shore at a distance of 100 yards. The creek has no wharves and is little used.

Upper Machodoc Creek is on the west side of Potomac River, 2 miles southwestward of Lower Cedar Point lighthouse. It has been improved by dredging a channel 15 feet deep from deep water to Dahlgren, $6\frac{1}{2}$ feet deep and 100 feet wide to Little Ferry Landing, 4 miles above the entrance, and 6 feet deep and 50 feet wide to **Milford Landing**, $6\frac{3}{4}$ miles above the entrance, with a turning basin at each place. Steamers from Washington drawing 6 feet make regular trips to the wharves as far as Little Ferry Landing. The entrance is also extensively used as an anchorage by small boats during the oystering and fishing season. There is a store at Berrys Wharf, $1\frac{1}{2}$ miles above the entrance, where gasoline and some provisions are obtainable. The buildings and water tank at Dahlgren are prominent.

Beabors Point light, on the south side of the entrance to Upper Machodoc Creek, is the guide to the entrance. There are no marks above the entrance, and strangers may find it difficult to keep in the dredged channels. In entering, pass 250 yards northward of Beabors Point light and steer west-northwestward to **Berrys Wharf**. Above this point the chart is the guide. For boats of greater draft than 7 feet, enter the dredged channel north of a can buoy lying $1\frac{7}{8}$ miles 182° true from Lower Cedar Point lighthouse. The channel has a 282° true (WNW. $\frac{3}{8}$ W. mag.) direction and is marked by a lighted range and buoys. There is a turning basin in front of the wharves at Dahlgren. The mean rise and fall of tides is 1.8 feet.

Cuckold Creek, 3 miles southeastward of Lower Cedar Point, is said to have a depth of $2\frac{1}{2}$ feet at the entrance and deeper water inside. It is unmarked and little used.

Piccowaxton Creek, $1\frac{3}{4}$ miles southeastward of Lower Cedar Point, can be entered only by small boats at high water.

Lower Cedar Point has a wharf and post village (**Morgantown**) on the end, is an important shipping point, and is used by the regular steamers of 10 feet draft. Gasoline, water, and provisions can be obtained, and there is autobus communication with Washington and a ferry to Colonial Beach. A channel 10 feet deep and 150 feet wide, with a turning basin 300 feet wide and 400 feet long, has been dredged to the wharf from the westward and is marked by buoys on both sides and a lighted range. The lights (front light on the wharf and the rear light on a white skeleton tower on shore) lead through the channel on a 61° true (ENE. mag.) course to the wharf. There is a strong cross current on both the ebb and flood tide. A depth of 7 feet can be taken to the wharf on a course between northwest and north-northwest, passing eastward of the shoal extending southwestward from the turning basin.

Popes Creek, $3\frac{1}{4}$ miles above Lower Cedar Point, is a post village, the terminus of a railroad from Baltimore and Washington, and is connected with Colonial Beach by motor boat. The creek is not navigable, but a depth of about 4 feet can be taken to the wharf at the railroad. Gasoline and provisions are obtainable and there are telephone and telegraph connections.

Port Tobacco River, having its entrance in the northern end of the shoal bight northward of Mathias Point, has a depth of 9 feet to the entrance, 7 feet for $1\frac{3}{4}$ miles above, and 3 feet to near the head.

Steamers drawing 6 feet make regular trips to **Brents Wharf** (Brentland post office) which is the principal landing. The generally used route in entering, which leads in a depth of 7 feet, is to pass $\frac{1}{4}$ mile eastward of Port Tobacco River Flats light and steer 17° true (NNE. mag.) for $1\frac{3}{4}$ miles to a position $\frac{3}{8}$ mile from the eastern shore at the entrance. Favor somewhat the eastern side at the entrance to avoid the shoal which extends nearly halfway across from Windmill Point, and then follow a general mid-channel course to the head. The mean rise and fall of tides is 1.5 feet.

Mathias Point landing and post office is on the northwest side of Mathias Point $\frac{1}{2}$ mile southwestward of Mathias Point lighthouse.

Nanjemoy Creek, $1\frac{1}{2}$ miles westward of Upper Cedar Point lighthouse, has a depth of 7 feet in the entrance and is navigable by small vessels for about 5 miles. It has considerable trade in wood products. The best water favors the east side at the entrance, as shown on the chart. **Riverside Landing** and post office is 3 miles west-southwestward of Upper Cedar Point lighthouse. Gasoline may be obtained. On the south side, $\frac{1}{2}$ mile southwestward of Metomkin Point, is **Stewart Landing**.

Somerset Beach is a landing on the south side, 1 mile southeastward of Maryland Point lighthouse. There is a store and post office about 1 mile distant.

Potomac Creek, 4 miles westward of Maryland Point lighthouse, has a depth of 7 feet at the entrance and 3 feet for 2 miles above. It is used only by light-draft boats carrying wood products. The best water favors the south shore at the entrance, as shown on the chart. **Bull Bluff**, high and wooded, is on the south side, at the entrance. **Smith Landing**, $1\frac{1}{2}$ miles eastward of Bull Bluff, has a depth of 7 feet at its end.

Aquia Creek, on the west side, 6 miles above Maryland Point lighthouse, has been improved by dredging a channel 6 feet deep and 100 feet wide to a railroad bridge $3\frac{1}{2}$ miles above the entrance, 6 feet deep and 60 feet wide to **Coal Landing**, $5\frac{3}{4}$ miles above the entrance, and widened in the upper 500 yards to a width of 100 to 150 feet to form an anchorage basin. Small boats can go 1 mile above Coal Landing. The channel from the entrance to the **Narrows**, 1 mile above the railroad bridge, leads between broad flats on either side. Above the Narrows the creek is narrow and crooked, the best water generally favoring the high land. The creek has considerable trade in wood products, carried in small sailing vessels and a few barges. Several beacons in a depth of 5 feet mark the channel for a distance of $1\frac{1}{2}$ miles above the entrance, to Thorney Point. Above this point there are no marks, and strangers may have difficulty in keeping in the dredged channel. The outer beacon is on the end of the shoal extending $\frac{7}{8}$ mile southward from **Brents Point**, on the north side, at the entrance. The mean rise and fall of tides is 1.6 feet.

The railroad bridge crossing Aquia Creek has a draw opening 28 feet wide, and a headroom of 19 feet at high water. The draw will be opened at all times between sunrise and sunset and between 9 p. m. and midnight on signal, unless a train is due within 15 minutes.

Dent Landing (Clifton Beach) is on Smith Point, $5\frac{1}{2}$ miles above Maryland Point lighthouse. Smith Point is marked by a light. An anchorage ground, the northeast and southeast corners of which are marked by buoys, is located between Brents Point and Widewater.

A wharf for an aviation field just westward is located $\frac{3}{4}$ mile south of Chopawamsic Island.

Chopawamsic Creek, on the west side, 1 mile below Quantico, has a depth of 6 feet across the bar at the entrance and deeper water for $1\frac{1}{2}$ miles above. The best water in the entrance leads northward and close westward of the island in the mouth. The creek is crossed by a highway drawbridge and a railroad drawbridge having an opening 24.8 feet wide, which will be opened at all times between sunrise and sunset on signal unless a train is approaching or due within 15 minutes.

Chicomuxen Creek, on the east side, opposite Quantico Creek, has a depth of 5 feet in the entrance and to Poseys Wharf, but shoals up rapidly above. It is little used except by boats carrying wood products.

Quantico Creek has a depth of 7 feet in a narrow, crooked channel in the entrance, and 2 feet for about 2 miles above. It is crossed by a railroad bridge at the entrance having a draw opening 30 feet wide. The draw will be opened at all times between sunrise and sunset on signal unless a train is approaching or due within 15 minutes. **Quantico** is a railroad station on the south side, at the entrance. The creek is considerably used as an ice harbor by local boats when the river above is closed. A pier and launch harbor just south of the mouth of Quantico Creek fronts the location of the United States Marine Barracks. The lights at night are prominent.

Mattawoman Creek, on the east side of Potomac River, 3 miles below Indian Head, has a depth of 7 feet across the flats at the entrance, deeper water for 4 miles above, and 6 feet for a farther distance of 2 miles. Steamers drawing 6 feet make regular trips to a landing $1\frac{3}{4}$ miles above the entrance. The creek is clear in mid-channel for a distance of $\frac{3}{4}$ mile, but above this point the channel is very narrow and crooked and leads between flats on both sides. It is sometimes partially marked by bush stakes, but is difficult without local knowledge. The marsh extending southeastward from Deep Point to the edge of the channel is marked by a clump of trees at the end. The mean rise and fall of tides at the entrance is 1.6 feet.

Powells Creek, opposite Mattawoman Creek, has a depth of 3 feet to a railroad bridge at the entrance and 1 to 2 feet for a short distance above. The railroad bridge has a draw opening 30 feet wide, with a headroom of 10 feet at high water; it will be opened between sunrise and sunset within four hours after notice of desire to pass. **Cherry Hill**, a village and railroad station 1 mile southward of the entrance, has landings for small boats.

Occoquan Bay and Creek, on the west side of Potomac River, westward of Indianhead and 23 miles below Washington, is the approach to the town of Occoquan and the District of Columbia workhouse, at the head of navigation 5 miles above the entrance. It has considerable trade, carried mostly in scows and schooners. The creek has been improved by dredging a channel 6 feet deep, with a width of 150 feet to Taylors Point and 100 feet to Occoquan. The mean rise and fall of tides is 1.8 feet. The bay is used as an ice harbor by local boats, when the channel of the river is closed above.

The channel for a distance of 3 miles is marked by buoys and lights and is easily followed. The range of the buoy on the west side of

the entrance and Sandy Point light, bearing 346° true (N. $\frac{3}{4}$ W. mag.), will lead in the best water to the entrance of the dredged channel. From the upper light, $\frac{3}{8}$ mile below the bridge, the best water favors the east bank to Occoquan, except in the bend $\frac{1}{2}$ mile above the bridge and just below Wagner Point, where it leads close along the southwest bank.

Occoquan Creek is crossed by a fixed railroad bridge $3\frac{1}{2}$ miles above the entrance, having a headroom of 66 feet at high water, and by a fixed highway bridge just above the wharves at Occoquan. There are depths of 10 to 14 feet anywhere in mid-channel off the wharves at Occoquan.

Neabsco Creek, a tributary of Occoquan Bay at its south end, has depths of 2 to 4 feet. It is crossed by a railroad bridge having a draw opening 30 feet wide.

Indianhead is a prominent, high, wooded bluff on the southeast side of the river 21 miles below Washington.

Glymont is a landing on the southeast side, $1\frac{1}{2}$ miles above Indianhead. There is a light on the end of the wharf.

Craney Island, northward of Glymont, is an islet marked by a clump of trees. It is surrounded by an extensive shoal, and there is a narrow unmarked channel with a depth of 7 feet northward of it.

Pamunkey Creek, 2 miles above Glymont, is nearly bare at low water above the entrance.

Gunston Cove, on the west side, 16 miles below Washington, has a depth of 3 to $4\frac{1}{2}$ feet across the bar, the deeper water favoring the southwest side. Above the bar there is a depth of 6 feet, except near the shores, to the junction of Accotink and Pohick Bays, and 2 to 4 feet in both bays for about $\frac{1}{2}$ mile. A wharf is on the north side of the cove just inside the entrance.

Dogue Creek, on the west side of Potomac River, opposite Marshall Hall, has depths of $2\frac{1}{2}$ to 5 feet, but is covered with grass and little used. White Stone Point light is at the southern entrance to the creek.

Marshall Hall, on the east side, 14 miles below Washington, is an excursion resort. The wharf has a depth of 10 feet.

Mount Vernon, the home of Washington, is on the west side, 13 miles below Washington, with which it is connected by steamer and electric railway. A channel 10 feet deep has been dredged across the flats to the wharf, but considerable shoaling has occurred. The wharf is not open to the public.

Bryan Point is marked by a white house and windmill and has a wharf with a depth of 13 feet.

Little Hunting Creek, opposite Bryan Point, has a depth of about 5 feet in a narrow dredged channel leading to a brickyard $1\frac{1}{4}$ miles above the entrance. The channel is sometimes marked by bush stakes, but is difficult without local knowledge. A bridge having a draw opening 27 feet wide crosses the creek just below the brickyard.

Piscataway Creek, on the east side, 11 miles below Washington, has depths of 2 to 4 feet but is covered with grass in summer and little used. Considerable sand dredging is done in the creek, and there is a dredged channel to a wharf $\frac{3}{4}$ mile above the entrance.

Sheridan Point has the ruins of a long wharf, marked by a light on the end extending to the edge of the channel.

Fort Washington has a wharf with a lighthouse (white tower) on the end. Opposite Fort Washington, a channel 12 feet deep and 100 feet wide was dredged in 1909 to a wharf on the west bank; the channel is marked by a light on the north side at the entrance and a light on the end of the wharf.

River View is an excursion resort on the east side, $\frac{3}{4}$ mile above Fort Washington.

Broad Creek, on the east side, 8 miles below Washington, has depths of 2 to 4 feet. There are landings for boats on the south side near the entrance, but the creek is covered with grass in summer and is little used.

Rosier Bluff is a prominent wooded bluff on the east side, 2 miles below Alexandria. **Fort Foot Wharf** is at the southern end and is marked by a light.

Hunting Creek, on the south side of Alexandria, has depths of $1\frac{1}{2}$ to 4 feet, but is covered with grass in summer and little used. It is crossed by two bridges. The lower bridge has a center pier draw, each opening 40 feet wide, and the upper bridge is fixed, but motor boats without houses can pass under it.

Alexandria has considerable trade, mostly in river and bay vessels and a few coasting vessels, the deepest draft being 18 feet. The area in front of the wharves has been dredged to a depth of 24 feet. Coal, water, gasoline, ice, and general provisions are obtainable, and there is a shipyard and a railway capable of hauling out vessels of 200 feet length, 11 feet draft forward and 15 feet aft.

Oxen Creek, eastward of the northern end of Alexandria, has depths of 1 to 3 feet, but is little used except by sand dredgers. Channels have been dredged by them across the flats. These are generally marked by bush stakes, and the channels are well indicated at low water by the grass.

Washington Harbor consists of three parts—Washington Channel, Virginia Channel, and Anacostia River.

Washington Channel leads between the sea wall of Potomac Park and the wharves of the city. It has been dredged to a depth of 20 feet over nearly the entire area and 24 feet along the eastern side to the head. The principal wharves of the city are on the eastern side of the upper part of the channel.

Virginia Channel, the main channel of Potomac River, leads to the wharves at Georgetown (West Washington), 4 miles above the junction with the Washington Channel. The channel has been improved by dredging to a present controlling depth of 23 feet and width of 400 feet and is marked by buoys. The depth in the channel is liable to some change on account of freshets.

Virginia Channel is crossed by two bridges below Georgetown. The lower, a railroad bridge, has a center pier draw, each opening 105 feet wide, with a headroom of 18 feet at high water when closed. The second, a highway and street railway bridge, has a center pier draw, each opening 100 feet wide, with a headroom of 18 feet at high water when closed. The Aqueduct Bridge, crossing the river at Georgetown, is fixed, and has a headroom of 27 feet at high water. Small unmasted vessels can go about 3 miles above. A concrete arch bridge just below the Aqueduct Bridge will pass boats of 60 feet masthead height.

Regulations prescribed for the two drawbridges crossing Virginia Channel require that the draws shall be opened on signal of three blasts sounded when a vessel is not more than 5 minutes distant from the bridge, when the clearance is less than 16.7 feet, except between 8.20 and 8.50 a. m., during which time the draws will not be opened except for the passage of Government vessels. When more than 16.7 feet the draws will be opened only during the periods 10 to 11 a. m., 2 to 3 p. m., and 8 p. m. to 6 a. m. The clearance is indicated by, distant reading gauges, one on the downstream end of the railroad pivot pier fender, one on the upstream end of the highway pivot pier fender, one $\frac{1}{2}$ mile above the bridge, and one $\frac{1}{2}$ mile below the bridge on the Potomac Park sea wall. Owners of tugs and power boats habitually using these waters are advised to reduce the height of their vessels under 16.7 feet in order that they may pass under or through the bridge at all times. No vessel shall pass under the closed draw span of either bridge at any time unless the vertical clearance between the lowest point of said span and the highest vertical projection of the vessel is at least 18 inches.

In case the draws can not be opened immediately, the fact shall be signaled from the bridges by the display of two red lights in a vertical line by night, or by the waving of a red flag or by four short blasts of a steam whistle by day.

Anacostia River has been improved by dredging a channel 20 feet deep and 400 feet wide to the United States Naval Gun Factory at Washington, $1\frac{1}{2}$ miles above the mouth, and is marked by buoys and easily followed to this point. It has a depth of 14 feet in a narrow unmarked channel to the Pennsylvania Avenue Bridge, $2\frac{1}{4}$ miles above the entrance, and is navigable for small boats and lighters to Bladensburg, Md., $7\frac{3}{4}$ miles above the entrance. It is crossed by several bridges between the naval gun factory and Bladensburg; Anacostia Bridge, just above the naval gun factory, has a draw opening 100 feet wide and a headroom of 21 feet at high water; Pennsylvania Avenue Bridge, $\frac{3}{4}$ mile above, is fixed and has a headroom of 28 feet at high water; the bridges above are fixed and have a least headroom of about $6\frac{1}{2}$ feet at high water. The draw in the Anacostia Bridge will be opened at any time during the hours 9 a. m. to 5 p. m.

Anchorage.—Vessels bound up or down the Potomac River anchor anywhere in the channel where the bottom is soft. St. Marys River is the best anchorage for vessels in the lower end, though deep draft vessels sometimes anchor for the night in Cornfield Harbor. Small craft can find secure anchorage in any of the tributaries near the lower end. There is no anchorage above Alexandria for vessels of any size, except off Georgetown below Aqueduct Bridge. Vessels usually go to the wharves. Motor boats anchor in the north end of Washington Channel, westward of the anchorage buoys.

Harbor Regulations.—Every vessel coming to anchor in the Potomac River between the junction of the Washington and Georgetown Channels of said river and the extension of the south line of P Street SW., in the city of Washington, shall anchor as near the flats in said river as possible, so that the channel of said river will not be obstructed; and if such vessel is to remain over 12 hours it shall be moored with both anchors, so as to give room for passing vessels

and so as not to swing and obstruct said channel. Every vessel coming to anchor in any other portion of the navigable waters in the District of Columbia shall also be so moored under the direction of the harbor master, or the pilot of the police boat acting in the harbor master's absence, as not to obstruct the channel, and be secured with an anchor at bow and stern so as to keep the long axis of the vessel parallel with that of the channel and prevent it from swinging so as to obstruct the free passage of the channel by other vessels.

No vessel shall be permitted to anchor in the Washington Channel of the Potomac River between a point 1,000 feet south of the south line of P Street and the north line of K Street south extended, each point to be designated by a white buoy; and all vessels coming to anchor above the north line of K Street aforesaid shall come to anchor as near the flats as possible and so that the channel will not be obstructed; and all vessels coming to anchor shall be so moored by the use of both anchors as to prevent obstruction of the channel within 400 feet of the nearest wharf, the said anchorage to continue only 24 hours unless otherwise ordered or directed by the harbor master.

Pilots.—Pilotage is not compulsory for vessels bound up the Potomac. If a towboat is taken a pilot is not needed, as the captain of the tug is a licensed pilot. Vessels taking a Maryland pilot in the entrance of Chesapeake Bay are usually turned over to a river pilot near Piney Point; the pilotage rate is the same as for the port of Baltimore.

For quarantine regulations, see page 93.

Freshets.—Freshets occur at irregular intervals, but as a rule do not interfere with the navigation of the river below Alexandria unless accompanied by floating ice. At Washington, during the highest freshet recorded, the river rose 13.26 feet at the foot of Seventeenth Street, and the deposit in the dredged channels decreased the depth from 20 feet to 14 feet in some places.

Ice.—During severe winters the tributaries of the Potomac are closed by ice, and the river is frozen over to Cedar Point; the upper part of the river is then closed to navigation. During ordinary winters the towboats and steamers plying on the river keep a channel open, but sailing vessels usually require the assistance of steam when bound to Alexandria or Washington.

Tides.—The mean rise and fall of tides is 1.5 feet at Point Lookout, 1.8 feet at Yeocomico River entrance, 2.2 feet at Blackstone Island, 1.6 feet at Lower Cedar Point, 1.3 feet at Maryland Point, 2 feet at Indian Head, and 3.3 feet at Washington.

Currents.—The velocity of the tidal currents in the Potomac River is variable and is influenced by the force and direction of the wind; the set is generally in the direction of the channel. During freshets there is little or no flood current. In the center of the channel off Alexandria slack water before the flood occurs about 9 hours after the time when the current turns northwest at Chesapeake Bay entrance (or approximately 55 minutes after time of low water at Washington), and slack water before the ebb occurs about 9 hours after the time when the current turns southeast at Chesapeake Bay entrance, or at the time of high water at Washington. These times are influenced by the force and direction of the wind and the freshet conditions, and may at times vary considerably.

DIRECTIONS, POTOMAC RIVER.

With the aid of the charts the following directions are good by day for vessels of 18 feet or less draft, except as stated in the description of Kettle Bottom Shoals. The channel is broad and unobstructed for a distance of 27 miles above Point Lookout to abreast Wicomico River, but above this point the aids are not sufficient to make the navigation of the river safe for strangers at night. Strangers of over 18 feet draft should take a pilot. Attention is called to the regulations on page 148 for passing through the firing zone.

In many places above Indian Head the shoals are clearly defined at low water by the grass growing on them or by the color of the water. Above Sheridan Point the channel is narrow and shoals abruptly on both sides. The buoys are reliable guides to keep in the channel and are placed to mark the best water.

1. **Entering from southward.**—From a position $11\frac{1}{4}$ miles northeastward of Smith Point lighthouse steer 307° true (NW. $\frac{1}{8}$ W. mag.) for $22\frac{1}{4}$ miles, passing $2\frac{3}{8}$ miles southwestward of Point Lookout lighthouse, 1 mile northeastward of Coan River gas and bell buoy, 1 mile southwestward of St. George Island, and to a position 1 mile southwestward of Piney Point lighthouse. Then follow the directions in section 2. The northern limit of fish traps on the south side of the river is a line drawn from the black buoy $11\frac{1}{2}$ miles north-northwestward of Smith Point lighthouse, through Coan River gas and bell buoy, and is marked by a line of black and white buoys.

1A. **Entering from northward.**—The easterly limit of fish traps extends 180° true (S. $\frac{1}{2}$ W. mag.) from Point No Point lighthouse to a black and white horizontally striped buoy $11\frac{1}{2}$ miles 90° true (E. $\frac{1}{2}$ S. mag.) from Point Lookout lighthouse, and then extends 240° true (SW. by W. $\frac{7}{8}$ W. mag.) to the red buoy lying $\frac{7}{8}$ mile southward of the latter lighthouse; vessels should keep eastward and southward of these limits. From a position $11\frac{1}{2}$ miles southward of Point Lookout lighthouse steer 302° true (NW. $\frac{5}{8}$ W. mag.) for $12\frac{1}{4}$ miles to a position 1 mile southwestward of Piney Point lighthouse.

2. **Piney Point to Blackistone Island.**—From a position 1 mile southwestward of Piney Point lighthouse steer 317° true (NW. $\frac{3}{4}$ N. mag.) for $31\frac{1}{2}$ miles; Ragged Point lighthouse should then bear 208° true (SW. by S. mag.) distant $\frac{3}{4}$ mile. Then steer 284° true (WNW. $\frac{1}{4}$ W. mag.) for nearly 8 miles to a position $\frac{3}{4}$ mile southwestward of Blackistone Island lighthouse.

3. **Blackistone Island to Lower Cedar Point.**—Kettle Bottom Shoals consist generally of small lumps of hardpan, with deep water close to and the lead will not serve as a guide to avoid them; there is often a pocket of slightly deeper water around the lump than is found near by. The area has been closely surveyed, but there are probably lumps which were not found with the lead. They occupy a stretch of the river about 8 miles long, as marked by the buoys, above Wicomico River. The generally used channel follows the perpendicularly striped buoys near mid-river. There is a general depth of 22 feet in the channel by avoiding the lumps, but this requires the best local knowledge. There are lumps with 14 to 17 feet near the sailing line, and strangers should not depend on carrying more than the latter depth under the most favorable conditions of daylight and a slow speed. A narrow channel with a depth of 23 to 24 feet leads along

the north bank passing Kettle Bottom Shoals. The channel is marked by range beacons and buoys, but is little used.

Straight channel over Kettle Bottom Shoals.—From a position $\frac{3}{4}$ mile southwestward of Blackistone Island lighthouse steer 292° true (NW. by W. $\frac{1}{2}$ W. mag.) for $4\frac{3}{4}$ miles to Kettle Bottom Shoals lower gas buoy, bell buoy alongside. Then steer 296° true (NW. by W. $\frac{1}{8}$ W. mag.) for $4\frac{1}{4}$ miles, passing close to the buoys, to the fourth one lettered "D," and then steer 304° true (NW. $\frac{1}{2}$ W. mag.) for $2\frac{3}{4}$ miles, passing close to the buoys, to Kettle Bottom Shoals upper gas and bell buoys. From Kettle Bottom Shoals upper gas and bell buoys steer 333° true (N. by W. $\frac{7}{8}$ W. mag.) for $2\frac{1}{8}$ miles to a position 350 yards eastward of buoy No. 13, and then steer 357° true (N. $\frac{1}{4}$ E. mag.) for 1 mile to a position $\frac{1}{4}$ mile westward of Lower Cedar Point beacon light; the elbow of the shoal marked by this light lies $\frac{1}{4}$ mile north-northwestward of the light and is marked by a red buoy. From $\frac{1}{4}$ mile westward of the light steer 3° true (N. $\frac{3}{4}$ E. mag.), passing westward of the buoy, to a position $\frac{1}{4}$ mile eastward of Cedar Point lighthouse, then follow the directions in section 4.

North channel over Kettle Bottom Shoals.—From a position $\frac{3}{4}$ mile southwestward of Blackistone Island lighthouse steer 297° true (NW. by W. $\frac{1}{8}$ W. mag.) for $4\frac{1}{2}$ miles, passing $\frac{1}{4}$ mile northeastward of Kettle Bottom Shoals lower gas buoy (bell buoy alongside) and $\frac{7}{8}$ mile southwestward of Cobb Point Bar lighthouse. Then steer 319° true (NW. $\frac{7}{8}$ N. mag.) on the line of the beacons of the lower range ahead, and leave buoys Nos. 8, 10, and 12 about 100 yards on the starboard hand.

Then steer 299° true (NW. $\frac{7}{8}$ W. mag.) on the line of the middle range astern (the rear light of this range is Cobb Point Bar lighthouse) until up with buoy No. 14. Leave this buoy about 35 yards on the starboard hand, steer 270° true (W. $\frac{1}{2}$ N. mag.) on the line of the beacons of the upper range astern, and follow the buoys; the end of Bluff Point will be nearly ahead. Continue the course until on the line of the mid-channel buoys, and then steer 306° true (NW. $\frac{1}{4}$ W. mag.) for $\frac{5}{8}$ mile to Kettle Bottom Shoals upper gas and bell buoys. Then follow the directions in the preceding paragraph.

4. Lower Cedar Point to Maryland Point.—Passing $\frac{1}{4}$ mile eastward of Lower Cedar Point lighthouse steer 350° true (N. $\frac{3}{8}$ W. mag.) for 3 miles, passing $\frac{1}{4}$ mile eastward of Persimmon Point Shoal light and continuing the course for $1\frac{1}{8}$ miles past it. Then steer 305° true (NW. $\frac{3}{8}$ W. mag.), heading for Port Tobacco River Flats light until $\frac{1}{4}$ mile from it, then steer 254° true (W. $\frac{7}{8}$ S. mag.) for 5 miles with Riverside Wharf a very little on the starboard bow. On this course leave Mathias Point Shoal lighthouse 350 yards on the port hand, Upper Cedar Point lighthouse 400 yards on the starboard hand, and buoy No. 21 about 500 yards on the port hand; and when 1 mile past this buoy and $\frac{1}{2}$ mile from Riverside Landing, steer 229° true (SW. $\frac{7}{8}$ W. mag.) with Maryland Point lighthouse a little on the starboard bow for $2\frac{3}{4}$ miles, leaving Metomkin Point Middle Ground light 500 yards on the port hand, buoy No. 28, 400 yards on the starboard hand, and buoy No. 23 about 300 yards on the port hand. From the latter buoy steer 253° true (W. by S. mag.) to a position 350 yards northward of Maryland Point lighthouse.

5. **Maryland Point to Indian Head.**—Passing 350 yards northward of Maryland Point lighthouse, steer 274° true (W. $\frac{7}{8}$ N. mag.) to a position about 200 yards northward of buoy No. 25, and then steer 287° true (WNW. mag.) with the lighthouse astern to the entrance of the dredged cut, which is 200 feet wide. Steer 303° true (NW. $\frac{1}{2}$ W. mag.) through the dredged cut, to the red gas buoy (flashing white) at the bend, then steer 332° true (NNW. mag.) for $1\frac{5}{8}$ miles to the lower end of the second dredged cut, then 338° true (N. by W. $\frac{1}{2}$ W. mag.) to the red gas buoy (flashing white) at the upper end, being guided by the buoys.

Then steer 354° true (N. mag.) for $5\frac{1}{2}$ miles, being guided by the buoys, to the black buoy 1 mile above Mallows Bay light (Smith Point). This course leads through the dredged channel off Wades Bay, which is 200 feet wide. From the black buoy 1 mile above Sandy Point light steer 12° true (N. by E. $\frac{5}{8}$ E. mag.) for Possum Nose (wooded bluff) for $2\frac{1}{8}$ miles to a position $\frac{1}{4}$ mile west-northwestward of a red gas buoy (flashing white).

Then steer 44° true (NE. $\frac{3}{8}$ E. mag.) for $2\frac{1}{4}$ miles to the lower end of the dredged cut through Mattawoman Shoals. Steer 38° true (NE. $\frac{1}{8}$ N. mag.) through the cut, being guided by the buoys. From the upper end steer 53° true (NE. by E. $\frac{1}{4}$ E. mag.) for Hallowing Point to a position 300 yards north-northwestward of the red buoy off Indian Head.

6. **Indian Head to Alexandria.**—From a position 300 yards north-northwestward of the red buoy off Indian Head, steer 84° true (E. mag.) for Glymont wharf light until $\frac{1}{4}$ mile from it; pass 200 yards off the wharf and steer 39° true (NE. mag.) to a position 150 yards westward of the red buoy off Pamunkey Creek. Then steer 347° true (N. $\frac{5}{8}$ W. mag.), passing 150 yards eastward of the black buoy $\frac{7}{8}$ mile above Hallowing Point and continuing the course for $\frac{3}{8}$ mile past the buoy, then steer 356° true (N. $\frac{1}{8}$ E. mag.) to a position 150 yards westward of the red gas buoy (flashing white) southward of White Stone Point. Follow the west bank above Whitestone Point at a distance of 200 to 250 yards until abreast of Whitestone Point light, then swing slowly to a 74° true (E. $\frac{7}{8}$ N. mag.) course for 2 miles following the buoys to the black buoy off Bryan Point. This course leads through the dredged channel off Marshall Hall which is 200 feet wide. Pass 150 yards southward of the black buoy off Bryan Point and steer 68° true (ENE. $\frac{5}{8}$ E. mag.) to a position 100 yards south of the end of the long wharf in ruins at Sheridan Point (outer piles marked by a light), then steer 50° true (NE. by E. mag.) for Fort Washington lighthouse. Pass 100 yards off the wharf and bring the lighthouse astern on a 14° true (N. by E. $\frac{3}{4}$ E. mag.) course to River View.

Pass 200 yards off the wharf at River View and steer 350° true (N. $\frac{3}{8}$ W. mag.) to a position 125 yards westward of the red buoy 1 mile above, then steer 8° true (N. by E. $\frac{1}{4}$ E. mag.) to Fort Foot light (on wharf just below Rosier Bluff), heading just clear of the end of the bluff and being guided by the buoys. Pass 100 yards off the wharf and steer 348° true (N. $\frac{1}{2}$ W. mag.) for $1\frac{1}{4}$ miles to a position 300 yards eastward of Jones Point lighthouse and westward of a red buoy, then steer northward, midway between the wharves at Alexandria and the buoys along the eastern side of the channel. Anchorage can be had in the channel between the wharves and the bouys.

7. **Alexandria to Washington.**—Pass 250 yards westward of the end of the abandoned railroad wharf at Marbury Point and steer 15° true (N. by E. $\frac{7}{8}$ E. mag.), heading for a prominent building on the south end of the point between Washington Channel and Anacostia River, and following the buoyed channel to abreast the mouth of Anacostia River. A wharf, with a light and fog bell on the end, is off Bellevue, and a light and bell on a dolphin just southward. The channel is 350 yards wide abreast the old railroad wharf and 150 yards wide abreast the steel plant. Above the intersection of Anacostia River and Washington Channel the chart is the guide. Small vessels and motor boats can anchor in the Washington Channel westward of the line of white buoys abreast the wharves of the city. (See "Anchorages" preceding.)

ST. JEROME CREEK

is on the western side of Chesapeake Bay 5 miles north of Point Lookout, and $2\frac{1}{2}$ miles 253° true (W. by S. mag.) from Point No Point lighthouse. It is shoal and of little importance; some oysters, wood, and farm products are shipped in light-draft vessels, but it is principally used as an anchorage for small craft engaged in oystering and fishing. The channel is subject to change and is unmarked. There is a store at the landing on Otter Point, just inside the entrance. The general depths in the creek are 4 to 7 feet as shown on the chart. The entrance to the south branch of the creek between Otter Point and Deep Point is nearly bare at low water, and this shoal extends northward of the line joining the points.

PATUXENT RIVER,

on the western side of Chesapeake Bay 87 miles above the entrance and 64 miles below Baltimore, has a depth of 30 feet into the entrance and 23 feet to Benedict, 12 feet to Lower Marlboro, 9 feet to Lyons Creek Wharf, and 7 feet to Bristol Landing, at distances of $18\frac{1}{2}$, 28, 36, and 40 miles, respectively, above Drum Point at the entrance. The mouth of the river forms a secure anchorage for vessels of any draft and is extensively used. Steamers from Baltimore of 8 to 9 feet draft make regular trips to all of the principal wharves as far as Lyons Creek Wharf. The river and its tributaries are also frequented by schooners and a few barges carrying wood products, and in the lower end by vessels engaged in the oystering and fishing industry.

Mill Creek, on the north side $11\frac{1}{2}$ miles westward of Drum Point, has several fish factories and is the center of a large oystering and fishing industry. It has a depth of 22 feet to the entrance, and 12 feet for $11\frac{1}{4}$ miles above in the main branch and $\frac{3}{4}$ mile above in the western branch (**Back Creek**).

Solomons Island, on the southwest side of Mill Creek, is the site of a village (Solomons post office) composed mostly of oystermen and fishermen. The cove northward of the island has depths of 10 to 20 feet, and is extensively used as an anchorage. There are several shipyards and marine railways, the largest capable of hauling out vessels of 200 tons, 125 feet length, and 10 feet draft. Gasoline, water, ice, and provisions may be obtained.

The approach to **Mill Creek** is marked by beacons and buoys. The deepest draft can be taken to the entrance by heading for the fish factories on the eastern side on a 330° true (NNW. $\frac{1}{8}$ W. mag.) course, passing eastward of the two beacons and entering the creek in mid-channel. A draft of 12 feet or more can be taken to the entrance from eastward by following the north shore at a distance of 200 yards, passing northward of a middle ground marked by buoys and covered with oyster stakes. Anchorage can be selected in a depth of 10 to 17 feet, anywhere southward or northeastward of a wooded islet inside the entrance, by giving the islet a berth of 200 yards. **Solomons Island** is connected with the mainland by a low fixed bridge which prevents navigation around the western end.

Pearsons Landing and post office and **Millstone Landing** are two steamer landings about 2 miles southeastward of **Solomons Island**. A ferry runs between **Solomons Island** and **Millstone Landing**.

Town Point is low and bare and has a steamboat landing (**Spencers Wharf**) and several buildings on the north side.

Mill Creek and **Cuckold Creek** have a common entrance with a depth of 15 feet, 1 mile northwestward of **Point Patience**. **Cuckold Creek** has a depth of 12 feet for $\frac{3}{4}$ mile and 8 feet for a farther distance of $\frac{3}{4}$ mile, and **Mill Creek** has a depth of 12 feet for $\frac{3}{4}$ mile and 8 feet for a farther distance of $\frac{1}{4}$ mile. The deepest draft entering are schooners drawing 10 feet. A black buoy on the end of the shoal on the north side at the entrance is the only mark. In approaching the entrance, pass 400 yards southward of the buoy and 600 yards northward of the point south-southwestward of it. The mid-channel is clear above the entrance.

Hellens Creek, $1\frac{3}{4}$ miles above **Point Patience**, has a depth of 3 feet across the bar at the entrance and 10 feet inside for $\frac{3}{4}$ mile. It is principally used as a harbor for small boats. The best water favors the eastern side in entering.

St. Leonards Creek, on the northeast side $7\frac{1}{2}$ miles above **Drum Point**, has a depth of 16 feet into the entrance and 10 feet for $2\frac{1}{2}$ miles above. Steamers from **Baltimore** make regular landings at two wharves just inside the creek, and schooners load to a depth of 10 feet for a distance of 3 miles above the entrance. The lower end of the creek forms a safe anchorage in any weather in depths of 16 to 23 feet. **Petersons Point light** is the principal guide to the entrance. In entering pass 600 yards eastward of the light and follow a mid-channel course through the mouth. The mid-channel is clear for $2\frac{1}{2}$ miles above.

Sotterley Wharf is on the southwest side of the river westward of the entrance to **St. Leonards Creek**.

Broome Island is a low bare point marked by **Broome Island light**. **Broome Island** post office is a small village northward of the point. **Island Creek**, on the east side of **Broome Island**, has a depth of 10 feet for $\frac{3}{4}$ mile above the entrance, but there are unmarked shoals close to the channel. It is little used except by small local craft.

Jones Wharf is on the south side of the river $\frac{7}{8}$ mile west-southwestward of **Broome Island light**, and **Parkers Wharf** is on the north side $1\frac{1}{2}$ miles north-northwestward of **Broome Island light**. The best water in approaching **Parkers Wharf** is from south-southeastward, the approach being marked by two beacons. Give the western side of **Broome Island** a berth of $\frac{3}{8}$ mile and leave the outer beacon

100 yards on the port hand, the inner beacon the same distance on the starboard hand, then head for the wharf.

Forrest Wharf is on the southwest side of the river $2\frac{5}{8}$ miles above Broome Island light.

Battle Creek, on the north side northward of Forrest Wharf, has a depth of 10 feet for 2 miles above the entrance, and is navigable for small boats for a farther distance of about 2 miles. The deepest draft entering are schooners drawing 10 feet. The entrance should be approached on a northeasterly course to avoid unmarked shoal spots on either side. The ruins of a wharf and freight house are on the eastern side at the entrance.

Dukes Wharf is on the south side of **Sheridan Point** 6 miles above Broome Island light. Directly opposite on the southwest side are **Washington** and **Persimmon Creeks**, both shoal and little used.

Trent Hall Creek and **Indian Creek**, on the west side just below Benedict, have depths of 5 feet in the entrances and 3 feet to near the heads.

Benedict is a village on the western side of Patuxent River $18\frac{1}{2}$ miles above the entrance. A cannery with twin stacks and a church spire are prominent. Schooners of 10 to 17 feet draft sometimes ascend the river to this point. The wharf has a depth of 9 feet at the end; there is a shoal southward of it which can be avoided by approaching the wharf on a northwesterly or westerly course.

Holland Point is a steamer landing directly opposite Benedict. There are numerous landings on both sides of Patuxent River between Benedict and the head, but the only villages are **Lower Marlboro** on the east side and **Nottingham** on the west side, distant 10 and 15 miles, respectively, above Benedict.

Swanson Creek, on the west side $11\frac{1}{2}$ miles above Benedict, has depths of 2 to 4 feet and is little used.

Hunting Creek, just above on the east side, has a depth of 3 feet across the flats at the entrance and for a distance of 3 miles above. It is frequented by motor boats and lighters. A railroad bridge having a draw opening 72 feet wide crosses the river 1 mile below Bristol Landing.

Western Branch, entering the river just above the bridge, is not navigable except for a short distance above the mouth.

Upper Marlboro is a village on the railroad, $13\frac{1}{4}$ miles westward of the fixed bridge at the head of navigation on Patuxent River.

Anchorage.—Deep-draft vessels frequently anchor in the mouth of the river for the night. Shelter from westerly winds is found in $3\frac{1}{2}$ to 4 fathoms, from $2\frac{1}{4}$ to $3\frac{1}{2}$ miles southward of Cove Point lighthouse and quite close in to the shore. If seeking shelter from easterly winds, stand into the entrance and anchor in 5 to 10 fathoms in the channel about $1\frac{1}{2}$ miles above Drum Point lighthouse. Good anchorage for light-draft vessels is found close into the north bank westward of Drum Point lighthouse, taking care not to get aground on the oyster bank, which is marked by buoys. Small local vessels up to 10 feet draft anchor in Mill Creek on the cove behind Solomons Island, but there is little room to swing at this anchorage. St. Leonards Creek is a safe anchorage for small vessels in any weather. The bottom in the channel as far as Benedict is generally soft, and vessels can anchor where convenient.

Supplies.—Gasoline and provisions are obtainable at Solomons, Benedict, and Lower Marlboro, and provisions at Nottingham. There is artesian water near the wharves at Solomons and Benedict. Coal in limited quantities can sometimes be obtained from the fish factories or canneries.

Repairs to hulls of small vessels and minor repairs to machinery can be made at Solomons, but Baltimore is the nearest place for extensive repairs to hull or machinery.

Pilots can be obtained at Solomons or Benedict. If the directions are closely followed, a pilot is not required below Benedict, but strangers, unless in small boats, should not go above that place without one.

Ice closes the river to near the mouth in severe winters.

Tides.—The mean rise and fall of tides is 1.2 feet at the entrance, 1.6 feet at Benedict, and 2.5 feet at Nottingham.

DIRECTIONS, PATUXENT RIVER.

The entrance is easy of access either day or night for vessels of 24 feet draft without a pilot, and vessels of 28 feet draft can enter by following the directions closely. The channel between the entrance and Benedict is narrow in places but is comparatively straight except off Point Patience, and the most prominent shoals are marked by buoys and lights. Strangers should have little trouble in taking a draft of 15 feet to Sheridan Point and 12 feet to Benedict in the daytime with the aid of the chart. Above Benedict the channel is narrow in places and obstructed by shoals and is not sufficiently well marked to be followed by strangers except in small boats.

The most prominent landmark in approaching Patuxent River from southward is **Cedar Point lighthouse** (white tower on red brick dwelling), on the end of a low bare point, and from northward is **Cove Point lighthouse** (white tower) and the high bluffs at Little Cove Point, $1\frac{1}{2}$ miles southward. In the entrance the most prominent marks are **Drum Point lighthouse** (white house on piles) and the fish factories and other buildings at Solomons Island.

To an anchorage inside the entrance.—To enter from southward, pass $\frac{3}{4}$ mile eastward of Cedar Point lighthouse and steer north-northwestward for $1\frac{1}{2}$ miles until Drum Point lighthouse bears 264° true (W. mag.); then steer for it on this bearing, passing $\frac{1}{8}$ mile or more northward of the black buoy northward of Hog Point. Or from northward, pass about 1 mile eastward of Cove Point lighthouse and steer 174° true (S. mag.) for $3\frac{3}{4}$ miles, passing eastward of Little Cove Point shoal buoy; when Drum Point lighthouse bears 264° true (W. mag.), steer for it on this bearing. Pass 200 yards or more southward of Drum Point lighthouse and anchor at discretion inside the lighthouse. (See "Anchorages" preceding.) At night red sectors in Drum Point lighthouse cover the shoals of less depth than 18 feet in the approach to the river and on the north and east sides of the anchorage inside the lighthouse.

Drum Point lighthouse to Sotterley Point.—From a position $\frac{1}{4}$ mile southward of Drum Point lighthouse steer 256° true (W. $\frac{3}{4}$ S. mag.) to a position $\frac{1}{4}$ mile southward of Sandy Point shoal buoy. Round

the buoy at this distance and steer 325° true (NNW. $\frac{1}{2}$ W. mag.) to Town Point. Give Town Point a berth of 400 yards and steer 285° true (WNW. $\frac{1}{8}$ W. mag.) to Point Patience, giving the light on the end a berth of about 200 yards. Then steer 5° true (N. by E. mag.) to the black buoy $\frac{3}{4}$ mile above, leaving it 300 yards on the port hand. From this steer 337° true (N. by W. $\frac{1}{2}$ W. mag.) for $1\frac{1}{4}$ miles, heading for Petersons Point light and leaving a red buoy well on the starboard hand. When $\frac{3}{4}$ mile past the buoy, steer 316° true (NW. $\frac{5}{8}$ N. mag.) for a little over 2 miles to a position $\frac{1}{4}$ mile northeastward of Sotterley Point Flats buoy.

Sotterley Point to Benedict.—From a position $\frac{1}{4}$ mile northeastward of Sotterley Point Flats buoy steer 295° true (NW. by W. mag.) for $1\frac{1}{2}$ miles to Broome Island light. Leave it 250 yards on the starboard hand and steer 305° true (NW. $\frac{3}{8}$ W. mag.) for $3\frac{1}{4}$ miles to a position $\frac{1}{4}$ mile southwestward of Battle Creek Shoal light. Then steer 324° true (NNW. $\frac{5}{8}$ W. mag.) for $2\frac{3}{4}$ miles to Sheridan Point, leaving a red buoy about 200 yards on the starboard hand, a black buoy about 200 yards on the port hand, and Sheridan Point about 200 yards on the starboard hand. Then steer 332° true (NNW. mag.) for the twin stacks of a cannery at Benedict. This course leads close to shoals on either side, and strangers should proceed with caution. When up with Benedict light pass westward of it, and anchorage may be had in the channel between the light and the black buoy off Town Point.

Benedict to the head.—The most difficult part of the channel between Benedict and Lyons Creek wharf is across the broad part of the river 1 mile below Nottingham, where there is a depth of 9 feet in a very narrow channel. The best water follows a curved line, favoring the western shore. There is a stone pile, with a depth of about 5 feet over it, near the center of the broad section. Above this point there is a depth of 15 feet, and the mid-channel is clear to Lyons Creek Wharf.

There is a depth of about 7 feet from Lyons Creek Wharf to Bristol Landing (Leon post office), and small boats can go $1\frac{1}{4}$ miles above to a fixed highway bridge. Some local knowledge is required to keep in the best water above Lyons Creek Wharf.

PATUXENT RIVER TO SEVERN RIVER.

The western side of Chesapeake Bay for a distance of 23 miles northward from Cove Point is unbroken by tributaries, and is generally high and wooded. The 5-fathom curve is nowhere more than $1\frac{5}{8}$ miles from shore. The outer limit of possible fish traps is marked by a line of black and white buoys.

Governors Run and Plum Point Landing are steamer landings 9 and 15 miles, respectively, above Cove Point lighthouse.

Chesapeake Beach is a summer resort $20\frac{1}{2}$ miles above Cove Point. A stack and water tank showing above the trees, and several buildings showing against the trees, are prominent. A long wharf extends to a depth of 11 feet. Gasoline and provisions are obtainable, and there is railroad communication with Washington.

Herring Bay, westward of Poplar Island and 8 miles 232° true (SW. by W. $\frac{1}{4}$ W. mag.) from Bloody Point Bar lighthouse, is extensively used as an anchorage. A shoal having depths of 2 to 4

feet extends from the north side south-southwestward nearly across the bay, and is marked at its south end by **Parkers Island Shoal light**. There is a depth of 12 feet around the south end. There is good anchorage in westerly weather eastward of the shoal in depths of 15 to 20 feet. Small vessels usually anchor westward of the shoal, where there are depths of 7 to 12 feet, protected against easterly winds to a considerable extent by the shoal outside. Small boats find shelter in **Rockhole Creek** at the northwest end, which has a depth of $2\frac{1}{2}$ feet at the entrance and $3\frac{1}{2}$ feet inside to a highway bridge 1 mile above. Gasoline and provisions are obtainable in the creek. **Fairhaven** is a post office and steamer landing on the west side of Herring Bay. The mean rise and fall of tides is 0.9 foot.

To enter **Herring Bay**, pass northward of **Holland Point Bar buoy** and head for **Parkers Island Shoal light** on a 245° true (WSW. $\frac{3}{8}$ W. mag.) course. Pass 200 yards southward and westward of the light and head for the end of **Fairhaven Wharf** on a north-north-westerly course. Anchorage can be had 100 to 500 yards eastward of the wharf in depths of 10 to 11 feet.

West River, 31 miles below Baltimore and 3 miles southwestward of **Thomas Point Shoal lighthouse**, has a depth of 15 feet in the entrance, gradually decreasing to 7 feet $4\frac{1}{2}$ miles above. Shoals extend nearly to mid-channel off many of the points. Those near the entrance are marked by buoys, and those above the entrance are sometimes marked by bush stakes. Steamers from Baltimore and **Annapolis** of 6 feet draft make regular trips to **Galesville** (**Galloway post office**) and several other wharves in the river. Gasoline and provisions are obtainable at **Galesville**, and there is a railway for hauling out small motor boats.

Directions, West River.—To enter from southward, bring **Bloody Point Bar lighthouse** astern on a 307° true (NW. $\frac{1}{8}$ W. mag.) course until **Thomas Point Shoal lighthouse** bears 11° true (N. by E. $\frac{5}{8}$ E. mag.), then steer 284° true (WNW. $\frac{1}{8}$ W. mag.) to **Curtis Point Shoal bell buoy**, and pass northward and 400 yards westward of it. Or from northward, pass eastward and southward of **Thomas Point Shoal lighthouse** and bring it astern on a 234° true (SW. by W. $\frac{3}{8}$ W. mag.) course, passing 500 yards westward of **Curtis Point Shoal bell buoy**. From here head southwestward, passing 100 yards southeastward of buoy No. 2, then steer 255° true (W. $\frac{3}{4}$ S. mag.) for 2 miles, and then be guided by the chart and the bush stakes.

Rhode River, on the north side of **West River**, has a depth of 10 feet for $1\frac{3}{4}$ miles above the entrance. Passenger steamers make landings at three wharves. There is a railway on the creek capable of hauling out boats of 4 feet draft and 40 feet length. **Cadle Creek**, on the north side, has a depth of 4 feet to the post village of **Mayo** near the head, where gasoline and provisions are obtainable. A shoal extends 400 yards southwestward from **Dutchman Point**, on the northeast side at the entrance to **Rhode River**, and vessels should favor the southwest side in entering. Above the entrance the mid-channel is clear if the points be given a good berth.

South River, just westward of **Thomas Point Shoal lighthouse**, has a narrow channel with a depth of 15 feet for 7 miles above the entrance and 9 to 12 feet into the tributaries. The principal shoals for a distance of 4 miles above the entrance are marked by buoys.

A highway drawbridge crosses the river 6 miles above the entrance. Between the hours of one hour before sunrise and one hour after sunset the draw will be opened on signal, if no person or vehicle is then in the way, for all vessels whose masts permanently remain standing or which have masts that may be unstepped, but which are 20 feet or more in height and 5 inches or more in diameter. The signal is three blasts of a whistle or horn, to be answered from the bridge by three blasts if the bridge can be opened immediately, or one blast if the bridge can not be opened immediately.

Numerous small creeks enter into the river. Many of these have good water in their channels and are extensively used by local yachts and motor boats.

Edgewater and Riverview are post villages near the bridge. Steamers from Baltimore of 6 to 8 feet draft make regular trips to the principal landings in the river, and these are the deepest draft entering. Gasoline and provisions are obtainable near the head.

Directions, South River.—From southward, a 315° true (NW. $\frac{5}{8}$ N. mag.) course with Bloody Point Bar lighthouse astern will lead to buoy No. 4. Or from northward, pass $\frac{1}{2}$ mile southeastward of Thomas Point Shoal lighthouse, and when 300 yards southward of Thomas Point Shoal buoy steer 271° true (W. $\frac{5}{8}$ N. mag.). Pass 300 yards southward of buoy No. 2 and then steer 306° (NW. $\frac{1}{4}$ W. mag.) to buoy No. 4. Pass westward of buoy No. 4 and northeastward of buoy No. 1, then steer northwestward, being guided by the chart, and give the points a berth of at least 400 yards.

Thomas Point Shoal extends $1\frac{1}{4}$ miles southeastward from the point, and is marked by **Thomas Point Shoal lighthouse** (white house on piles) and a black buoy.

SEVERN RIVER AND ANNAPOLIS HARBOR.

Severn River, on the west side of Chesapeake Bay 124 miles above the entrance and 26 miles below Baltimore, is the approach to Annapolis, the capital of Maryland and the site of the United States Naval Academy. The cove at the entrance to the river, known as **Annapolis Roads**, has depths of 18 to 45 feet and is extensively used as an anchorage. The river is frequented by many small local craft and by small naval vessels as far as Annapolis, the deepest draft being 16 feet and usual draft not exceeding 12 feet. There is little business by water above Annapolis except in small boats seldom exceeding 6 feet in draft.

A channel 30 feet deep and 180 feet wide has been dredged to the Naval Academy at Annapolis, and had a depth of about 27 feet in 1915. The dredged channel is marked by spar buoys on the northeast side and can buoys on the southwest side, and the 12-foot curve on the southwest side is marked by spar buoys as far as Annapolis. The river has a natural channel with a depth of 18 feet for 7 miles above Annapolis and 6 feet for 2 miles farther. The channel above Annapolis is only partially marked, but is broad and easily followed with the aid of the chart.

Tolly Point, on the south side of the entrance to Severn River, is wooded and has no prominent marks. **Tolly Point Shoal** extends 1 mile southeastward from the point and is marked by a gas and bell buoy on the end. There is a slough through the shoal, $\frac{5}{8}$ mile west-

northwestward of the buoy, through which boats of 6 feet draft pass, but it is unmarked and strangers should not attempt to use it.

Greenbury Point Shoal extends southward and southeastward from Greenbury Point, and is marked by **Greenbury Point Shoal lighthouse** (white house on piles) and a row of red buoys along the southwest side. The 18-foot curve lies 250 yards southwestward of the lighthouse, and there are depths of 6 feet and less for 400 yards west-northwestward of it. A naval radio station is on Greenbury Point. The six tall towers are prominent over a large area up and down the bay.

Back Creek, a tributary of Severn River on the southeast side of Eastport, has a depth of 9 feet in the entrance and 12 feet inside, shoaling to 7 feet near the head. The entrance is very narrow and has extensive shoals on either side. The creek is used as a harbor for small boats.

Eastport is a small town just southward of Annapolis, with which it is connected by a bridge. It has a shipyard and a railway for hauling out vessels of 60 tons and 7 feet draft.

Annapolis is the site of the **United States Naval Academy**, which occupies the entire northeastern part of the city between Spa and College Creeks. The two inclosed basins and the entire water front on the northeast side and for a distance of $\frac{3}{8}$ mile on the southeast side are a part of the Naval Academy. The steamboat landing and private wharves are on the northwest side of Spa Creek, between the Naval Academy grounds and the bridge across the creek. **Market Slip**, 250 yards below the bridge, is $\frac{1}{8}$ mile long and 40 yards wide and has a depth of 8 feet to near the head. It is open to the public and extensively used by small craft. The mouth of Spa Creek below the bridge has depths of 10 to 13 feet and is extensively used as an anchorage. Gasoline, provisions, ice, coal, and water can be obtained at Annapolis, and there are machine shops for ordinary repairs to motors. Storm warnings are displayed. Annapolis is connected with Baltimore and Claiborne by steamer.

Spa Creek is crossed by a highway bridge just above the wharves having a center pier draw, each opening 38 feet wide with a headroom of 7 feet at high water when closed. The bridge is opened at all times between sunrise and sunset on a signal of three blasts, and the operating machinery is accessible to vessel captains at other times. Favor the southeast side in approaching the draw to avoid a shoal on the northwest side. The creek has a depth of 8 feet for $\frac{3}{4}$ mile above the bridge and the mid-channel is clear.

College Creek, on the northwest side of Annapolis, has a depth of 11 feet in the entrance and 8 feet to near the head. It is crossed by three bridges, all having draw openings, the least width of opening being 38 feet. The draws are opened at all times between sunrise and sunset on a signal of three blasts of a whistle or horn. The best water in entering leads along the south side to near the lower bridge.

Weems Creek, $1\frac{1}{2}$ miles above Annapolis, has a depth of 12 feet for 1 mile above the entrance and 6 feet to the head. It is crossed by a highway bridge having a center pier draw, each opening 21 feet wide.

Round Bay, an expansion of Severn River 4 miles above Annapolis, has depths of 17 to 22 feet and is frequented by motor boats.

Anchorage.—Deep-draft vessels anchor in Annapolis Roads off the entrance in depths of 20 to 45 feet, sheltered from westerly winds. There is good anchorage in the river northeastward of the Naval Academy in a depth of 21 feet, and 30 feet in the dredged anchorage basin, which is often occupied by naval vessels made fast to the mooring buoys. Small vessels and motor boats usually anchor in the mouth of Spa Creek, where there are depths of 10 to 13 feet.

Bridges.—Two bridges cross Severn River just above Annapolis. The lower, a highway bridge, has a lift draw, with an opening 75 feet wide, and a headroom of 16½ feet at mean low water when closed. The second, an electric railway bridge, has a center-pier draw, each opening 60 feet wide, with a headroom of 5.7 feet at high water when closed. Both bridges are opened at any time of day or night on a signal of three blasts, unless a train is approaching or expected.

Pilots.—Local boatmen who are competent pilots will be found near the entrance if desired.

Ice seldom interferes with navigation except in severe winters, and then only for a limited time.

Tides.—The mean rise and fall of tides is 0.9 foot and is greatly influenced by winds. The tidal currents seldom exceed ½ knot in strength.

DIRECTIONS, SEVERN RIVER.

The following directions are for vessels of 16 feet draft to Annapolis in the daytime. Strangers, unless of light draft, should not attempt to enter at night.

From southward.—From the outer end of the dredged channel, lying ½ mile northeastward of Tolly Point Shoal gas and bell buoy, steer 316° true (NW. ¾ N. mag.) in the dredged channel, leaving the buoys at a distance of 30 yards, until westward of Greenbury Point Shoal lighthouse and 30 yards northeastward of buoy No. 9. Then steer 333° true (N. by W. ¾ W. mag.) for ¾ mile until southwestward of buoy No. 14; on this course the lighthouse wharf, in front of a group of white houses, will be a little on the starboard bow and the U. S. Naval Experimental Station buildings on the port bow. From buoy No. 14 a 305° true (NW. ¼ W. mag.) course will lead to the dredged anchorage basin off the Naval Academy.

From northward.—Pass eastward and ¼ mile southward of Hackett Point Shoal buoy No. 33 and steer 244° true (WSW. ¼ W. mag.) with Greenbury Point Shoal lighthouse well on the starboard bow, and heading for buoys Nos. 5 and 6 until in the dredged channel, which leads between the buoys. This course leads through an area of possible fish traps. Then steer 316° true (NW. ¾ N. mag.) in the dredged channel and follow the directions in the preceding paragraph to Annapolis.

SEVERN RIVER TO PATAPSCO RIVER.

The cove between Greenbury Point and Hackett Point has depths of 10 to 14 feet in the north end. The channel at the entrance is narrow and leads between extensive flats, and is marked on the eastern side by a red buoy. The cove and the creeks at the head are

frequented by motor boats and small vessels carrying farm and wood products. **Mill Creek** has a depth of 10 feet at the entrance in a very narrow unmarked channel and 8 feet to near the head. **White Hall Creek** has a depth of 12 feet at the entrance and 7 feet to near the head; the channel at the entrance is narrow and crooked and is usually marked by a post or bush stake. **Crabbing Point Creek** has a very narrow entrance, with a depth of about 2 feet, and deeper water inside.

Sandy Point lighthouse is a red dwelling on brown cylindrical base. Deep-draft vessels should pass $\frac{1}{8}$ mile or more eastward of it.

Magothy River, westward of Baltimore lighthouse, has a depth of 13 feet at the entrance and for a distance of $5\frac{1}{2}$ miles above, but has many shoal spits and middle grounds of less depth close to the channel. The usual draft of boats using it is 3 to 5 feet and deepest draft 10 feet. There are no wharves except for small craft. **Deep Creek**, on the south side just inside the entrance, has a depth of 7 to 9 feet in mid-channel and is sometimes used as an anchorage for small craft. **Mountain Point**, on the north side at the entrance, is a high, wooded bluff with a bare sandy point outside of it. A privately marked channel leads into Magothy Narrows east of the middle ground in Tarcoat Cove. There are many excellent anchorages for small boats in the numerous tributaries to Magothy River, and this locality is a favorite cruising ground for local yachts.

The entrance to Magothy River is narrow and marked by buoys. **Approaching the entrance from northward**, a 226° true (SW. $\frac{3}{4}$ W. mag.) course from buoy No. 3C on the Craighill Channel will lead $\frac{3}{4}$ mile westward of Baltimore lighthouse and to the buoys at the entrance. **Approaching from southward**, strangers should pass eastward of Sandy Point lighthouse and give the shore on the southwest side a berth of $\frac{1}{2}$ mile until up to the red buoy at the entrance. Either course leads through an area of possible fish traps. Pass 100 yards southward of the buoy and steer northwestward into the river, passing northward of the black buoy. There are only a few private marks above the entrance, but strangers should have no trouble in taking a draft of 6 feet for 5 miles by keeping in mid-channel and giving the point a good berth.

Baltimore lighthouse, on the western side at the entrance of the dredged channel leading to Baltimore, is a white octagonal house on brown pier.

PATAPSCO RIVER AND BALTIMORE HARBOR.

Patapsco River, on the west side of Chesapeake Bay 136 miles above the entrance, is the approach to the city of Baltimore. The river is $3\frac{1}{2}$ miles wide at the mouth, but the entrance is obstructed by extensive shoals. A channel 35 feet deep and 600 feet wide has been dredged from the 35-foot depth southward of the entrance of the river to Fort McHenry, at the entrance of the basin at Baltimore, the total length of the dredged channel being 16 miles. The controlling depth to Baltimore was 34 feet in 1923. **Craighill and Cutoff Channels** lead through the shoals southward of the entrance to the river, and **Brewerton and Fort McHenry Channels** lead from the mouth of the river to Fort McHenry. The channels have been widened at the turns and two anchorage basins 600 feet wide and 35

feet deep have been dredged on the southwest side of the Fort Mc-Henry Channel.

Bodkin Point, on the south side at the entrance, is low and covered with scattered trees. A chimney in Bodkin Creek is prominent. A shoal extends northward from the point to the edge of the dredged channel.

Bodkin Creek, just westward of Bodkin Point, has a depth of 11 feet at the entrance and 7 to 9 feet inside for a considerable distance into all of its three branches. The channel at the entrance is very narrow and leads between extensive shoals. It is marked by buoys as far as the fork, and the narrowest part of the channel at the entrance is also usually marked by bush stakes. The chimney of a garbage disposal plant on the point between **Main Creek** and **Back Creek** is prominent. The draft of boats using the creek does not usually exceed 6 feet, and strangers should not enter with a greater draft. From the black spar buoy at the outer end of Rock Point Shoal a 136° true (SE. $\frac{5}{8}$ S. mag.) course for $2\frac{1}{2}$ miles will lead to the outer buoy. In entering, be guided by the buoys and bush stakes, leaving them at a distance of about 25 yards.

North Point, on the north side of Patapsco River at the entrance, is wooded and marked by a large and a small water tank. A pleasure park just eastward of the entrance to Shallow Creek is marked by a pier with pavilion at the end, and $\frac{1}{2}$ mile northward is a wharf for a ferry to Deep Landing (Rock Hall).

Old Road Bay, just westward of North Point, has a depth of 7 to 14 feet. A rock, nearly bare at low water, near the middle of the entrance is marked by a horizontally striped buoy, and above this point there are no marks. **North Point Creek** and **Jones Creek**, emptying into the bay from northward, have depths of 6 to 8 feet, but are unmarked and frequented only by small produce and pleasure boats. The bridges crossing both creeks near their entrances have draw openings 40 feet wide.

Sparrows Point, a town on the north side $2\frac{1}{4}$ miles west-northwestward of North Point, is the site of large iron and steel works and a shipbuilding plant. Several factory buildings and many chimneys and tanks are prominent. A channel, dredged to a depth of 35 feet and marked by a lighted range and buoys, leads to the wharves on the south side on a 354° true (N. $\frac{1}{8}$ E. mag.) course. Channels have also been dredged to several wharves on the west side. Sparrows Point is the terminus of a railroad.

Bear Creek, just westward of Sparrows Point, has a depth of 12 feet for $3\frac{1}{2}$ miles above the entrance. The principal shoals for a distance of $1\frac{1}{2}$ miles above the entrance are marked by buoys. There are no marks above, and shoals extend for a considerable distance from many of the points. The creek is frequented principally by small produce and pleasure boats. There are no wharves except for small boats. Two bridges, each having center-pier draws, cross the creek just above the entrance; the least headroom at high water when closed is 5 feet. A highway bridge having a draw opening crosses the creek $2\frac{1}{4}$ miles above. **Humphreys Creek**, a tributary of Bear Creek just above the lower bridges, has a depth of 13 feet in the entrance and 7 feet in mid-channel for $1\frac{1}{4}$ miles. Boats entering Bear Creek from northwestward should pass between Fort Carroll and the red buoy $\frac{1}{4}$ mile east-northeastward, and when $\frac{1}{8}$ of a

mile beyond it head for the eastern end of the bridges until abreast of a black buoy, then head for the draws. Or, from southward, a 9° true (N. by E. $\frac{3}{8}$ E. mag.) course from gas and bell buoy No. 12B will lead to the draws.

Rock Creek, on the south side of Patapsco River 4 miles above Bodkin Point, has a depth of 11 feet to near the head, except at the narrows westward of Fairview, where the channel has a depth of 8 feet and width of only 75 to 100 feet. The channel at this point is marked by buoys, and the mid-channel is clear above. A channel has been dredged 7 feet deep and about 50 feet wide through the shoal off Fairview, about $\frac{1}{8}$ mile eastward of the buoys marking the natural channel, and is marked by a black buoy on the eastern side and a red buoy on the western side, but strangers are advised to enter by the natural channel. **White Rocks**, on the eastern side of the entrance to the creek, show about 15 feet above high water, and are prominent when entering from eastward. Boats of 6 feet or more draft should pass northward of them. The creek is frequented by passenger steamers from Baltimore drawing $7\frac{1}{2}$ feet, and many pleasure boats in summer. Gasoline may be obtained at Fairview. To enter Rock Creek from northwestward, a 160° true (S. by E. $\frac{1}{8}$ E. mag.) course from the black gas buoy at the intersection of Brewerton and Fort McHenry Channels will lead to the red buoy on the western side at the entrance. From there favor the western shore to the narrows and be guided by the buoys, leaving them close-to.

Stony Creek, 1 mile northwestward of Rock Creek, has a depth of 10 to 14 feet to near the head, and the same depth to near the head of Nabbs Creek, the principal tributary. The entrance is obstructed by shoals, the one extending westward from **Stony Point** having several rocks bare at all times. The channel around the western end of this shoal has a depth of 15 feet and width of 70 yards and is marked by buoys. Above this point the mid-channel is clear to the head. Steamers from Baltimore of 6 to $7\frac{1}{2}$ feet draft are the deepest entering. The creek has several landings and summer resorts and is frequented by many pleasure boats in summer. A highway bridge having a center-pier draw, each opening 50 feet wide, with a headroom of 6 feet at high water, crosses it $\frac{3}{4}$ mile above the entrance. Gasoline may be obtained from a wharf above the bridge.

Fort Carroll is a stone and concrete structure with Fort Carroll light (white structure) on the southwest side. The center of Fort McHenry Channel leads 400 yards southwestward of the light.

Hawkins Point is marked by a water tank and a large pile of slab. Leading Point is the site of the quarantine station. A buoyed channel leads to the quarantine wharf in Thomas Cove.

Curtis Bay and Curtis Creek, on the southwest side of Patapsco River $1\frac{3}{4}$ miles west-northwestward of Fort Carroll, are the approaches to large coal and oil wharves and several industrial plants at South Baltimore, and to the Coast Guard depot on Arundel Cove. A channel 250 feet wide and 35 feet deep, with a turning basin at the head, has been dredged from the main channel of Patapsco River across Curtis Bay to the wharves at South Baltimore, where are located the coal piers of the Baltimore & Ohio Railroad, having a depth of 30 feet alongside, and several other wharves with depths

of 25 to 35 feet. The channel is marked by buoys on each side and a lighted range, which is hard to pick up during the day.

Curtis Creek has a natural depth of 20 feet to abreast the entrance of Arundel Cove, $1\frac{3}{4}$ miles above South Baltimore, and 12 feet for a farther distance of 2 miles into Marley Creek. A highway bridge having a center pier draw, with a headroom of 9 feet at high water eastward of the draw, crosses the creek $\frac{3}{4}$ mile above the head of Curtis Bay. The channel above Curtis Bay has ample width and is easily followed with the aid of the chart. Shoals extend southeastward from **Ferry Point** on the north side of Cabin Branch, and northwestward from **Walnut Point** just below the bridge; except at these points the mid-channel is clear for 3 miles above Curtis Bay. A channel dredged to 24 feet leads from just above the drawbridge to the ordnance depot opposite Arundel Cove.

Cabin Branch, on the west side of Curtis Creek just above South Baltimore, has a depth of 14 feet to a drawbridge $\frac{3}{8}$ mile above the entrance. There are depths of 14 to 18 feet at the industrial wharves on the north side. In entering, vessels should pass southward of the buoy marking the end of the shoal extending south-southwestward from Ferry Point, and head in on a 293° true (NW. by W. $\frac{3}{8}$ W. mag.) course through the dredged channel to the wharves, thence favoring the northern side to the drawbridge.

Arundel Cove is the site of the Coast Guard depot. There is a depth of 17 feet at the wharf just outside the cove, and 12 feet to the wharves inside. The entrance to the cove is marked by several buoys.

To enter Curtis Bay, pass southward of gas buoy No. 7M, and steer 267° true (W. $\frac{3}{8}$ N. mag.) in the Curtis Bay channel, leaving the buoys at a distance of 50 yards; the coal piers and a brick chimney at South Baltimore will be ahead on this course. There is a lighted range ahead on this course, but it is hard to see in the day. Anchorage can be had eastward or east-northeastward of the coal piers in depths of 24 to 30 feet, being careful to give the north shore a berth of 300 yards, or in mid-channel southward of the coal piers in depths of 23 to 26 feet. If bound above South Baltimore, pass midway between **Sledds Point** and the ends of the coal piers, favor the eastern side of Curtis Creek until past Ferry Point, then the western side to the bridge. Pass through either side of the draw and eastward of the red buoy just southward of it and follow a general mid-channel course above.

Colgate Creek, on the north side of Patapsco River, northeastward of Curtis Bay, has a depth of 6 feet in a narrow channel to a fixed bridge $\frac{3}{4}$ mile above the entrance. A bridge having a draw opening 30 feet wide and a headroom of 8.6 feet crosses the creek at the entrance. The draw will be opened on a signal of three blasts at any time between 6 a. m. and 6 p. m. from December to March, inclusive, and at any time between 6 a. m. and 10 p. m. during the remainder of the year. **Point Breeze**, on the west side at the entrance, is a pleasure park, and has several prominent buildings. The best water in entering Colgate Creek leads eastward of a horizontally striped buoy and follows the eastern shore at a distance of about 250 yards from abreast **Dundalk** (marked by a brickyard and black water tank) to the first bridge.

The **Northwest Branch** of Patapsco River, also known as **The Basin**, forms the main part of Baltimore Harbor. The entrance leads between Fort McHenry on the west and Lazaretto Point on the east. **Fort McHenry** is on a point, marked on the east side by Fort McHenry lighthouse (steel skeleton tower), and **Lazaretto Point** is marked by Lazaretto Point lighthouse (white cylindrical tower). Northwest Branch has depths of 20 to 35 feet in the eastern end and 24 feet to the head, with a few areas of less depth near the shores. The best water favors the southwest side from the entrance to Locust Point, and the northeast side from Locust Point to the head. There are anchorages on the northeast side between Lazaretto Point and Fells Point and on the south side westward of the Baltimore & Ohio Railroad wharves at Locust Point, the anchorage limits being marked by white buoys. There are depths of 16 to 35 feet at the principal wharves. The Baltimore & Ohio Railroad wharves, extending from Fort McHenry northwestward for $\frac{3}{4}$ mile, have depths of 20 to 35 feet, and the Pennsylvania Railroad wharves, northward of Lazaretto Point, have depths of 27 to 31 feet. The wharves along the western side at the head of the harbor are used by passenger and freight steamers to points on Chesapeake Bay. The wharves from the northwest corner of the harbor eastward to Jones Falls are municipal wharves and have depths of 24 feet alongside, the three easterly ones being public wharves and used for the discharge of lumber, sea food, and produce.

Middle Branch of Patapsco River, also called **Spring Garden Channel**, extends from southward of Fort McHenry, westward and northward for a distance of 3 miles. It has been improved by dredging two channels leading from the Fort McHenry channel to Ferry Bar Point, thence one channel to near the head of navigation. Ferry Bar Channel has a depth of 35 feet and present width of 150 feet to opposite the Western Maryland Railroad Pier, thence a depth of 30 feet to Ferry Bar Point and is marked by spar buoys on the northern side and gas buoys and spar buoys on the southern side. Many of the channels leading to the wharves are also marked by buoys. Spring Garden Channel above Ferry Bar Point has a controlling depth of 27 feet to the Hanover Street Bridge, thence 22 feet to the head of navigation. The principal wharves have depths of 11 to 32 feet, the deepest draft being found at the Western Maryland Railroad coal wharves (Port Covington). The channel is used by many barges, large schooners, and steamers, the deepest draft being 30 feet to the Western Maryland Piers. The old Ferry Bar Channel has been abandoned and will not be maintained.

Middle Branch is crossed by two bridges. Hanover Street Bridge, $\frac{3}{8}$ mile above Ferry Bar Point, has a draw opening 150 feet wide and a headroom of 34 feet at high water. **Western Maryland Railroad bridge**, 1 mile above Hanover Street Bridge, has a center-pier draw, each opening 83.5 feet wide, with a headroom of 8 feet at high water when closed. The draw of the Hanover Street Bridge will be opened upon notice by 3 blasts of a whistle or horn blown on the vessel at any time between 5 a. m. and 9 p. m. At any other time notice of intention to pass through the draw should be given the superintendent of the bridge by telephone or otherwise, either at the bridge before 9 p. m. or at his residence thereafter.

The courses in the dredged channels of Middle Branch are as follows: Ferry Bar Channel, from Fort McHenry Channel, 270° true (W. $\frac{1}{2}$ N. mag.) for $1\frac{1}{2}$ miles to gas buoy No. 9; 236° true (SW. by W. $\frac{1}{2}$ W. mag.) to 40 yards southward of gas buoy No. 10; 314° true (NW. $\frac{1}{2}$ N. mag.) for $\frac{7}{8}$ mile, passing through the Hanover Street Bridge and to a point $\frac{1}{8}$ mile southward of the railroad bridge; and 6° true (N. by E. $\frac{1}{8}$ E. mag.) through the bridge and to the head of the channel.

Pilots.—Pilotage for the port of Baltimore is compulsory for foreign vessels, vessels from a foreign port, and all vessels sailing under register, except American vessels laden either in whole or in part with coal or coke mined in the United States. Pilotage fees are given on page 94.

Anchorage.—The anchorage limits in the harbor of Baltimore are prescribed by law and it is the duty of the harbor master to carry out its provisions. Vessels can find good anchorage in 18 to 24 feet on either side of Fort McHenry Channel above Fort Carroll, keeping at least 300 feet outside of the dredged channel marked by buoys.

Two buoyed anchorage basins, each 600 feet wide, $\frac{5}{8}$ mile long, and 35 feet deep, have been dredged along the southwest side of the Fort McHenry Channel. The lower one extends from a point westward of Fort Carroll to the channel leading to Curtis Bay, and the upper lies southward of Lazaretto Point and southeastward of the entrance to the channel leading into Middle Branch.

Three anchorage areas are prescribed in Northwest Branch, and are marked by white buoys at the corners.

Anchorage No. 1, lying westward of the Baltimore & Ohio Railroad wharves at Locust Point, is southward of a line from the west corner of Shaws coal pier to the northeast corner of Beacham & Bro. shipyard. No vessel is allowed to anchor within 300 feet of any pier fronting this anchorage.

Anchorage No. 2, lying eastward of Fells Point, is northeast of a line from the foot of Fell Street to the coal wharf foot of Ninth Street and west of a line from Obers Wharf to corner of Canton company bulkhead. No vessel is allowed to anchor within 300 feet of any pier fronting this anchorage.

Anchorage No. 3, lying northward of Lazaretto Point, is northeastward of a line from Fell Street to coal pier foot of Ninth Street, westward of a line from Baltimore Dry Dock Co. Wharf to the elevator at foot of Sixth Street, and southward of a line from Baltimore Copper Co. bulkhead to Obers Wharf.

Supplies.—All kinds of supplies are obtainable in Baltimore Harbor. Coal in unlimited quantities can be obtained from wharves equipped for rapid coaling or from lighters, and water can be obtained from the wharves or from water boats.

Repairs.—There are facilities at Baltimore for repairs to hulls of vessels of any size, and large machine and boiler shops for all kinds of repairs to machinery. (For capacity of the largest dry docks and railways see page 5.)

Storm warnings of the United States Weather Bureau are displayed from the American Building and from the Anchorage Building, corner of Broadway and Thames Street.

A **United States Branch Hydrographic Office** is established at the customhouse. Bulletins are posted here giving information of value to seamen, who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service.

The **Superintendent of Lighthouses** for the fifth district has offices in the customhouse. Mariners are requested to report direct to him by radio or other prompt means defects or deficiencies in aids to navigation affecting the waters of Chesapeake Bay and tributaries and the outer coast between Cape Henlopen and Cape Henry, described in this volume. Recommendations as to aids to navigation or their improvement may be submitted to him or to the Commissioner of Lighthouses at Washington, D. C. Light List and Buoy Lists of the U. S. Lighthouse Service may be purchased here.

Ice.—Baltimore Harbor and Patapsco River are frozen over during severe winters, but steamers and ice boats keep the dredged channels open so that vessels assisted by steam can always enter the harbor. The smaller tributaries of Patapsco River are often closed by ice for extended periods. Ice in the main channel is most often met with in the vicinity of Seven Foot Knoll lighthouse, where ice packs are of frequent occurrence.

Tides.—The mean rise and fall of tides is 1.1 feet.

Regulations for passing dredges.—Steamers passing dredges engaged in improving the channels shall not have a speed greater than 6 statute miles an hour, and their propelling machinery shall be stopped when abreast of the dredges.

Vessels drawing less than 12 feet of water must keep outside of the buoys marking the ends of mooring lines of dredges.

Vessels must not anchor on the ranges of stakes or other marks placed for the guidance of dredges, nor in such a manner as to obstruct the channel for other vessels.

Dredges and operating plant in the prosecution of the work must not obstruct any part of the channel unnecessarily.

Vessels must not run over or disturb stakes or other marks placed for the guidance of dredges.

The position of breast and stern anchors of the dredges shall be marked by buoys plainly visible to passing vessels.

While vessels are passing the dredges in the channel all lines running across the channel from the dredges on the passing side must be entirely slackened.

Speed regulations.—No vessel shall move in the harbor at a greater rate of speed than 7 nautical miles an hour westward of a line from Hendersons Wharf (Fells Point) to the foot of Hull Street (Locust Point), and 9 nautical miles an hour eastward of said line, and no vessel shall move in the Patapsco River or tributaries within a distance of 300 feet from any pier or bulkhead at a greater rate of speed than 8 nautical miles an hour.

Quarantine for the port of Baltimore is in accordance with State laws and the quarantine regulations of the city of Baltimore, and is in charge of the health officers of the port. The quarantine station is at Leading Point. Vessels subject to inspection should come to anchor in the quarantine anchorage off the point until granted pratique. The national quarantine regulations are the minimum requirements.

DIRECTIONS, PATAPSCO RIVER AND BALTIMORE HARBOR.

Directions from Chesapeake Bay entrance to the entrance of the dredged channel leading to Baltimore are given on page 100. Directions from Chesapeake City to Baltimore are given on page 238.

The dredged channels are well marked by buoys and lighthouses and by lighted ranges. The buoys are generally arranged in pairs to mark both sides of the channel, and gas buoys are used to mark the turns. The buoys marking the Craighill Channel are distinguished by the letter C after the number, the Cutoff Channel by the letter K, the Brewerton Channel by the letter B, and the Fort McHenry Channel by the letter M.

Shoals with little depth lie on both sides of the Craighill and Cutoff Channels, and strangers should follow the dredged channel unless in small boats. The natural channel of the river outside the dredged channel, from the upper end of Cutoff Channel to Baltimore, has depths of 15 to 24 feet; shoals make out from many of the points and are usually marked by buoys. Strangers of 10 feet or more draft should follow the dredged channels.

The following directions lead in the 35-feet dredged channel to the entrance of Northwest Branch (the Basin) at Baltimore. Deep-draft vessels should not attempt to enter at night without a pilot.

From the gas and bell buoy at the southern end of Craighill Channel steer 0° true (N. $\frac{5}{8}$ E. mag.) on the Craighill Channel range, and follow the buoys which mark the edges of the dredged channel. When up with gas and bell buoy No. 9C, steer 341° true (N. by W. $\frac{1}{8}$ W. mag.) and follow the black buoys which mark the western edge of the widened part of the dredged channel until up with gas and bell buoy No. 5K; or vessels can continue on the Craighill Channel range to gas buoy No. 2K, at the intersection with the Cutoff Channel range.

Then steer 329° true (NNW. $\frac{1}{8}$ W. mag.) on the Cutoff Channel range, following the buoys and passing over $\frac{1}{4}$ mile westward of Seven-Foot Knoll lighthouse. Cutoff Channel range shows 400 yards westward of a large and a small water tank on North Point, and about midway between the houses at the outer end of North Point Wharf and the trees at the inner end. When up with gas and bell buoy No. 13K steer 310° true (NW. $\frac{1}{8}$ N. mag.) in the widened part of the channel until up with gas and bell buoy No. 3B; or vessels can continue on the Cutoff Channel range to gas buoy No. 14K, at the intersection with the Brewerton Channel range.

Then steer 291° true (NW. by W. $\frac{1}{2}$ W. mag.) on the Brewerton Channel range and follow the buoys which mark the edges of the dredged channel until up with gas and bell buoy No. 12B. Brewerton Channel range shows between the ruins of a large building and a water tank on Hawkins Point; neither light structure is prominent by day. From gas and bell buoy No. 12B steer 307° true (NW. $\frac{1}{8}$ W. mag.) in the widened part of the channel to gas and bell buoy No. 4M; or vessels can continue on the Brewerton Channel range until abreast gas buoy No. 1M. Then steer 320° true (NW. by N. mag.) for Fort McHenry lighthouse, and follow the buoys which mark the sides of the Fort McHenry Channel to Lazaretto Point. Above this point the chart is the guide.

Vessels bound for the Middle Branch leave Fort McHenry Channel opposite gas buoy No. 20M. Courses are given on page 181. There are several private channels to industrial wharves southeast of Lazaretto Point, all marked by buoys.

EASTERN SHORE, CAPE CHARLES TO CHESCONESSEX CREEK.

The eastern side of Chesapeake Bay from the entrance northward to the south end of Pocomoke Sound is indented by numerous small creeks, most of them obstructed by bars at the entrances. The creeks are frequented by many small craft engaged in oystering and fishing and the transportation of produce, and many of them by passenger steamers engaged in the bay trade. Strangers seldom enter except in small boats. The shore is low and without prominent natural landmarks except Butlers Bluff, about midway between Fisherman Island and Old Plantation Flats lighthouse, which shows bare, bluff faces when viewed from the bay. Cape Charles, Harborton, and Onancock are the principal towns, and there are numerous other post villages and landings. Fish weirs are numerous in season but are prohibited in water more than 18 feet in depth.

The whole of the northern point of the entrance to Chesapeake Bay is generally known as **Cape Charles**. It includes Smith Island, Fisherman Island, The Isaacs, and the south point of the mainland.

Smith Island and **Cape Charles lighthouse** are described under "Coast from Cape Henlopen to Cape Charles," on page 79.

Fisherman Island is low. Several low buildings, a water tank, and a flagstaff of the national quarantine station are on the northwest side. There is a wharf in front of the quarantine station. A light is exhibited from the end of the wharf.

The Isaacs is a bare, marshy island marked by two towers. The south point of the mainland is low and bare on the extreme south end but high and wooded back of the point.

Fisherman Inlet is described under "Inside waters, Cape Henlopen to Cape Charles," on page 92.

Old Plantation Creek, $2\frac{1}{2}$ miles southward of the town of Cape Charles and $1\frac{1}{2}$ miles eastward of Old Plantation Flats lighthouse, has a depth of $1\frac{1}{2}$ feet across the bar at the entrance and for a distance of 2 miles above, and is frequented by local boats of $3\frac{1}{2}$ feet draft at high water. The channel is narrow, and there are many bars and middle grounds, which usually show discolored. It is usually marked by bush stakes but is difficult without local knowledge. The best water across the flats is about $\frac{3}{8}$ mile southward of the mouth. The opening in the thick woods at the mouth and a shanty on an island inside the mouth are the only marks visible from outside.

Cherrystone Inlet, on the eastern side of Chesapeake Bay 9 miles northward of Fisherman Island, is the approach to the town of Cape Charles and to several small creeks farther north. It is marked by **Old Plantation Flats lighthouse** (white house on piles) and by several other lights and buoys. The mean rise and fall of tides is 2.3 feet.

A channel 16 feet deep and 200 feet wide has been dredged across the bar a little northward of Old Plantation Flats lighthouse, and

northward along Cherrystone Inlet to the entrance of Cape Charles Harbor. In 1922 there was a depth of 14 feet in the entrance to the harbor. The channel is exposed to westerly winds but is partially protected by the flats westward and is seldom too rough for entrance by motor boats. Owing to the limited space in the channel and harbor small boats are sometimes exposed to injury by the steamers and tows. The tidal currents set across the entrance to the channel south of the entrance to Cape Charles Harbor, but follow the general direction of the channel above. Ice does not interfere with navigation. For regulations for passing dredges see "Hampton Roads."

Cape Charles is the terminus of the New York, Philadelphia & Norfolk Railroad and is connected with Old Point Comfort and Norfolk by passenger steamers. It has a large trade carried in steamers, car floats, and barges, mostly between Cape Charles and Norfolk, and is also an important shipping point for sea food and produce brought here in motor boats and small vessels. Gasoline and provisions are obtainable, and there is water on the wharf.

Cape Charles Harbor is an artificially dredged basin, 300 yards long and 200 yards wide, on the south side of the town. A jetty extends 1,600 feet westward from the north side of the entrance. The harbor is owned by the railroad company, but is open to general navigation. In 1922 it had a depth of 14 feet in the entrance, 13 feet at the wharf on the north side, and 15 feet through the center to the car-float slips at the eastern end. There was a depth of about 12 feet at the coal elevator at the eastern end of the bulkhead along the south side, but the southwest side of the harbor was shoal, having depths of 5 to 8 feet. Steamers and small boats load and discharge at the wharf on the north side, and motor boats make fast to the bulkhead on the south side and at the eastern end. Small craft seeking shelter in the harbor should anchor so as not to interfere with the steamers, tugs, and barges of the railroad company.

Cherrystone Inlet has a depth of 8 feet for 3 miles above the entrance of Cape Charles Harbor, above which the depths are 2 to 4 feet. It is used by fish steamers up to 10 feet draft as far as the fish factory on Cherrystone Island and by local oyster and produce boats above, their draft seldom exceeding 6 feet. The channel is marked by lights to Cherrystone Island, and is sometimes marked by bush stakes above, but the channel is narrow and difficult without local knowledge. Boats of 3 feet draft can cross the bar at low water into Cherrystone Inlet anywhere between the outer end of the north jetty at Cape Charles Harbor and Cherrystone Island, but the bar between Cherrystone Island and Wescott Point is often bare at low water.

Kings Creek, east-southeastward of Cherrystone Island, has a depth of $3\frac{1}{2}$ feet across the bar at the mouth and for 1 mile above, and is frequented by boats of 2 to 5 feet draft. There is a long wharf with a house on the end on the south point at the entrance, and an incomplected bridge just inside, with a single clear opening 22 feet wide. There is a shoal, bare at low water and sometimes marked by bush stakes, on the north side outside the entrance. The best water in entering leads from Cherrystone Island southeastward to within 300 yards of shore, then northeastward close along the end of the wharf on the south side, and then favors the north side to the

opening in the bridge. There is a railway on the creek capable of hauling out boats of 40 feet length and 4 feet draft.

Directions, Cherrystone Inlet.—Cherrystone Inlet can be entered from southward, eastward of Old Plantation Flats, with a depth of 16 feet, and there is a depth of 12 feet across the bar anywhere between Old Plantation Flats lighthouse and a point $\frac{1}{2}$ mile northward.

The dredged channel across the bar is marked by a lighted range and has a 53° true (NE. by E. $\frac{1}{4}$ E. mag.) trend, leading 520 yards northwestward of Old Plantation Flats lighthouse. Having crossed the bar on the range, steer 19° true (NNE. $\frac{1}{4}$ E. mag.) for the white light (red structure) on the south side of the entrance to Cape Charles Harbor in range with the white light on a post with slatted daymark on the middle of the north jetty. This course leads westward of a red buoy, 180 yards eastward of a black bell buoy, and to a position 120 yards eastward of Cherrystone Bar light (skeleton tower, fog bell). Then steer 6° true (N. by E. mag.), passing eastward of a white light on a black pile structure (No. 1) and midway between the light (red structure) on the east side, and the light (single pile with black daymark No. 3) on the west side, just southward of the end of the north jetty. Then turn eastward for the entrance to the harbor, passing midway between the light on the end of the north jetty (fog bell) and the red buoy southward. Pass 70 yards southward of the light near the inner end of the north jetty and enter the harbor in mid-channel.

Hungers Creek, on the eastern side of Chesapeake Bay 8 miles northward of Cape Charles, has a depth of about 4 feet in a narrow channel for 2 miles above the mouth. It is entered through a narrow channel which commences in front of a large red-roofed house $2\frac{1}{2}$ miles southward of the mouth of the creek, and follows close along the eastern shore to the mouth. There is a shoal, bare in places at low water, along the western side of the channel. The channel is usually marked by bush stakes but requires local knowledge. The flats are covered by marsh grass in summer. The creek has no wharves, but there are several landings from which produce is shipped in boats of 2 to 5 feet draft.

The Gulf, emptying into the channel leading to Hungers Creek, has a depth of about 1 foot to near the head and is little used. There are no wharves.

Mattawoman Creek, emptying into Hungers Creek from eastward, has a depth of about 4 feet for 1 mile in a narrow crooked channel and 2 feet to the head of navigation. The best water in entering lies close along the eastern shore, northward and eastward of an island marked by two shanties.

Nasawaddox Creek, on the eastern side of Chesapeake Bay $12\frac{1}{2}$ miles northward of the town of Cape Charles, has a depth of 4 feet across the bar at the entrance and deeper water inside for several miles. The channel at the mouth is marked by an entrance buoy. The channel above the entrance is narrow and unmarked, the flats on each side are nearly bare at low water, are covered by marsh grass in summer, and are usually well defined. The creek is frequented by local craft of 5 feet or less draft. The landings are Bayford, $11\frac{1}{2}$

miles above the entrance, and **James and Stewarts Wharves**, on opposite sides of the creek 4 miles above the entrance. There is a depth of 4 feet to the upper wharves. There is a store and post office at **Bayford** and gasoline is obtainable. The mean rise and fall of tides is 1.8 feet.

Church Creek, on the south side of **Nasawaddox Creek**, has a depth of about 2 feet to the head and is little used.

Warehouse Creek, on the south side of **Nasawaddox Creek**, has a depth of 3 feet to within 1 mile of the post village of **Franktown**. The best water leads close around the point on the east side at the entrance.

Occohannock Creek, on the eastern side of **Chesapeake Bay** 18 miles above the town of **Cape Charles**, has a depth of 6 feet across the bar at the entrance, 6 feet inside to **Shields Wharf** and post office $5\frac{1}{2}$ miles above the entrance, and 3 feet for a farther distance of $\frac{1}{2}$ mile to a fixed bridge. Steamers from **Baltimore** drawing 5 to 7 feet make regular trips to four wharves in the creek, and they are the deepest draft entering. The channel across the bar at the mouth is marked by buoys and bush stakes, but is narrow and changeable, and difficult without local knowledge. The channel above the entrance is also narrow and difficult, but the ends of the shoals are marked by buoys to near **Concord Wharf**. There is a store and post office at **Concord Wharf**, on the south side 2 miles above the entrance, and a post office and store at **Davis Wharf**, on the north side 4 miles above the entrance; gasoline is obtainable here, and there is artesian water on the wharf. **Morley Wharf** is directly opposite. In approaching the creek a clump of trees on the north side standing well away from the main woods is the only landmark. There is a grassy islet on the north side, just outside the mouth. The mean rise and fall of tides is 1.8 feet.

Craddock Creek, just northward of **Occohannock Creek**, has a depth of 3 feet across the flats at the entrance and 4 or 5 feet inside to near the head. The best water lies along the south shore in approaching the entrance and along the north side of the creek in entering, then in mid-channel to the head. There are no commercial wharves.

Nandua Creek, on the eastern side of **Chesapeake Bay** 9 miles southward of **Watts Island lighthouse**, has a depth of 7 feet in a dredged channel across the flats at the mouth, the same depth in a natural channel to **Cedar View Wharf**, $2\frac{3}{4}$ miles above, and $5\frac{1}{2}$ feet to the post village of **Nandua**, 4 miles above the mouth. It is navigable for a farther distance of 1 mile, but is shoal and little used. Steamers from **Baltimore** of $5\frac{1}{2}$ to 7 feet draft make regular landings at **Cedar View Wharf** and **Nandua**. The channel across the flats at the entrance is narrow and shifting and is marked by buoys, and by bush stakes maintained by the steamboat company. The flats usually show discolored water. The bend in the channel westward of **Cedar View Wharf** and the approach to **Nandua Wharf** are also generally marked by bush stakes. There is a store at **Nandua** at which some provisions are obtainable. The only landmark in approaching the entrance is a prominent clump of pine trees standing clear on the south side. The mean rise and fall of tides is 1.7 feet. In entering, strangers should be guided by the buoys and bush stakes, but local knowledge is required to carry the best water.

Butchers Creek, 2 miles northward of Nandua Creek, has a depth of 2 feet at the entrance and deeper water inside. There are no wharves, and the creek is little used.

Pungoteague Creek, on the eastern side of Chesapeake Bay 7 miles southward of Watts Island lighthouse, has a depth of 11 feet to the town of **Harborton**, 4 miles above the mouth, and 6 feet to **Boggs Wharf**, 5 miles above the mouth, above which it shoals rapidly. Steamers from Baltimore of 6 to 8 feet draft make regular trips to these landings and to **Evans Wharf**, on the north side $\frac{1}{2}$ mile eastward of Harborton. There is a fish factory at Harborton, to which steamers of 10 feet draft go. Gasoline and provisions are obtainable at Harborton. The channel as far as Harborton is crooked, but is well marked by buoys and lights. Posts, upon which lights are maintained during the fishing season, are maintained by the fish factory owners in places. The mean rise and fall of tides is 1.7 feet.

The best water in approaching the entrance is from southwestward, eastward of the black can buoy off the mouth of Nandua Creek, but a depth of 7 feet can be carried across the flats at the mouth, heading for **Pungoteague Creek light** (black cylindrical tower) on any course eastward of 130° true (SE. mag.). In entering, pass 200 yards southward and eastward of Pungoteague Creek light and steer northeastward for **Hack Neck Shoal light** (red pile structure), passing 100 yards westward and northward of it. Then steer eastward, passing southward of a black buoy; then steer 65° true (E. by N. $\frac{5}{8}$ N. mag.) to leave red buoy No. 8 a little on the starboard hand; then steer eastward for $\frac{1}{2}$ mile, passing close northward of the buoy. Then steer 105° true (ESE. $\frac{1}{8}$ E. mag.) for $\frac{5}{8}$ mile, passing close southward of the next buoy. The course then leads 75° true (E. $\frac{3}{4}$ N. mag.) for $\frac{3}{8}$ mile, passing close northward of the next buoy, and then follows a general mid-channel course to Harborton. The channel between Harborton and Boggs Wharf is marked by bush stakes, but is narrow and difficult without local knowledge.

There is a depth of about 4 feet at high water from Pungoteague Creek to Onancock Creek, close along shore eastward of the marshy islands between them, but the channel is difficult without local knowledge.

Onancock Creek, on the eastern side of Chesapeake Bay 4 miles 149° true (SSE. $\frac{1}{4}$ E. mag.) from Watts Island lighthouse, has a depth of 7 feet to the town of **Onancock**, at the head of navigation $5\frac{1}{2}$ miles above the mouth. Steamers from Baltimore drawing 7 feet make regular trips to Onancock, and to **Finneys Wharf**, on the south side, and **Poplar Cove Wharf** on the north side, 1 and $2\frac{1}{4}$ miles, respectively, below Onancock, and these are the deepest draft entering. Finneys Wharf is on the eastern side of a point having a shoal making northward from it and must be approached from eastward. Gasoline and provisions are obtainable at Onancock. The mean rise and fall of tides is 1.7 feet.

The channel across the flats at the entrance of Onancock Creek had a depth of 9 feet in 1922. The creek is marked by **Onancock Creek light** (black pile structure) and by buoys and beacons. The channel in 1922 led close southward of the light at the entrance, then east-southeastward for $\frac{3}{4}$ mile, then east-northeastward for $\frac{1}{2}$ mile to the point on the north side (marked by a beacon), approximately as

shown on the chart. Above the entrance the channel is crooked and narrow in places but is marked by beacons, red on the south side of the channel and black on the north side. Strangers of about 5 feet draft should be able to go to Onancock with the aid of the chart and the aids. The controlling depth to the town was 8 feet in 1922.

Chesconessex Creek, $3\frac{1}{2}$ miles 118° true (SE. by E. mag.) from Watts Island lighthouse, has a depth of 12 feet for $2\frac{1}{2}$ miles above the entrance between the shoals, 5 feet for a further distance of 1 mile to the village of Chesconessex, and 2 to 3 feet for $\frac{3}{4}$ mile above Chesconessex. The creek is frequented by many small local boats and an occasional schooner up to 7 feet draft to Chesconessex. The channel has ample width at the entrance, gradually contracting to a narrow slough at Chesconessex, and has extensive flats on each side. The entrance is marked by buoys, and the channel above is sometimes marked by bush stakes at the turn, but is difficult without local knowledge. Strangers should be guided by the chart and the aids. Some provisions are obtainable at Chesconessex. The mean rise and fall of tides is 1.7 feet.

Pompeo Creek, on the north side of Chesconessex Creek, northwestward of Tobacco Island, has a depth of 6 feet for 2 miles above its junction with Chesconessex Creek; it has no wharves, and is frequented only by small local boats. A draft of 3 feet at high water can be taken from the head around the eastern side of Tobacco Island into Chesconessex Creek.

POCOMOKE SOUND

is on the eastern side of Chesapeake Bay, 48 miles northward of the entrance. Extensive flats occupy most of the sound, though a channel, wide and deep at the south end and shoal at the north end, leads from southward to the entrance of Pocomoke River, the most important tributary. The sound is separated from Tangier Sound on the western side by a string of marshy islands and large shoals, marked near their southern end by Watts Island lighthouse (white cylindrical tower). The shores of the sound are low, and there are no prominent natural landmarks. The most prominent shoals along the main channel are marked by buoys from the entrance to the mouth of Pocomoke River. The boundary between Maryland and Virginia is indicated by a line of white buoys. The sound is frequented by many local oyster and fishing boats, by steamers from Baltimore, and by a few schooners and barges, the deepest draft being 9 feet. Small boats can enter through Broad Creek. The mean rise and fall of tides is about 2 feet.

Watts Island is marshy and sparsely wooded and has no prominent marks. The channel through the flats northward of it has a depth of 3 feet and is sometimes marked by bush stakes, but is difficult without local knowledge. Watts Island lighthouse is on an islet just southward of the island.

Little Fox Island consists of a group of bare, marshy islands. Great Thoroughfare, northward of Little Fox Island, has a least depth of 4 feet at high water and is sometimes used by local boats, but is difficult without local knowledge.

Great Fox Island is low and marked by a single prominent poplar tree. There is a group of small red oyster houses on the eastern side.

Cedar Straits, northward of Great Fox Island, has a depth of $3\frac{1}{2}$ feet at high water through a narrow unmarked channel, and is little used even by local boats.

Deep Creek is a shallow, unimportant creek on the southeast side of Pocomoke Sound. The main entrance between the shoals is $3\frac{1}{2}$ miles east-northeastward of Watts Island lighthouse. It has a depth of 7 feet for 5 miles above the main channel of Pocomoke Sound to the mouth of the creek, through a crooked channel with extensive flats on each side, and 2 feet to the head of the creek. There are no wharves, and it is used only by small local boats, many of which come from Hunting Creek through the **Notch**, good for a draft of 3 feet at high water. The channels are not marked and are difficult without local knowledge.

Hunting Creek, on the southeast side of Pocomoke Sound, has a depth of 7 feet to the mouth of **Bagwell Creek**, 2 miles above the mouth, and 4 feet to the wharf at the post village of **Hopkins**, on the southern branch. It is frequented by many small local boats and a few schooners, the deepest draft being 7 feet. The approach to the creek from the main channel of Pocomoke Sound leads eastward along the south side of **Guilford Flats** for $3\frac{1}{2}$ miles, then southward for $1\frac{1}{2}$ miles to the mouth, and is marked by Guilford Flats light and several buoys. In entering, approach the light on a northeasterly course to avoid a 6-foot spot $\frac{1}{4}$ mile westward of it, pass $\frac{1}{4}$ mile southward of the light and steer 82° true (E. $\frac{1}{8}$ N. mag.) for $1\frac{5}{8}$ miles until $\frac{3}{8}$ mile past buoy No. 1, then steer 158° true (S. by E. $\frac{3}{8}$ E. mag.) for $1\frac{3}{4}$ miles to the buoys at the entrance. Above the entrance the mid-channel is clear for about 1 mile, above which it is narrow and is usually marked by posts with arms or by bush stakes, but is difficult without local knowledge.

Guilford Creek is $2\frac{1}{2}$ miles northeastward of the mouth of Hunting Creek, with which it has a common approach from the main channel of Pocomoke Sound. There is a depth of 7 feet to the entrance and 2 to 5 feet inside. There are no wharves, and it is frequented only by local boats of 2 to 4 feet draft. The channel is marked by a buoy at the entrance and sometimes by bush stakes above.

Messongo Creek, on the eastern side of Pocomoke Sound, southward of Saxis Island, has a depth of 6 feet for 5 miles above its junction with the main channel of Pocomoke Sound, shoaling gradually to about 1 foot at the village of **Marsh Market**, $2\frac{1}{2}$ miles above. The creek is frequented only by small local boats. It is marked by buoys at the entrance. To enter, pass $\frac{1}{2}$ mile north-northwestward of Guilford Flats light and steer 53° true (NE. by E. $\frac{1}{4}$ E. mag.) for 3 miles to the first buoy. Above the buoys the mid-channel is clear to the head.

A draft of $2\frac{1}{2}$ to 3 feet at high water can be taken from the mouth of Messongo Creek, northwestward through **Starling Creek** to the south end of the village of Saxis, and many local boats frequently use this passage. The cove at the northwest end of Starling Creek has a depth of 1 to 2 feet and is much used as an anchorage by small boats.

Saxis, a village on Saxis Island, at the northeast end of Pocomoke Sound, is the center of a considerable oystering and fishing industry. Steamers between Baltimore and Pocomoke River make landings at

a pier $\frac{3}{8}$ mile offshore abreast the town, communication being had with the shore by small boats. There is a wharf on the western side of the town which can be reached only at near high water. Gasoline and provisions are obtainable.

Pocomoke River, at the northeast end of Pocomoke Sound, has a depth of $4\frac{1}{2}$ feet across the flats at the mouth (called the **Muds**), though the bottom is very soft and vessels run with their keels 1 to $1\frac{1}{2}$ feet in the mud. The river is navigable for vessels to the town of Snow Hill, 25 miles above the mouth. After passing the Muds the channel has ample depth and width and is easy of navigation for a distance of 20 miles, above which it has been improved by dredging to a present depth of 8 feet and width of 100 to 130 feet as far as Snow Hill, with several cut-offs. The channel in the upper end is unmarked, is narrow and crooked, and some local knowledge is required to carry the best water. The water is fresh above Rehoboth and can be used in boilers.

There is considerable trade on the river in steamers and some schooners and barges, the deepest draft being 7 or 8 feet. Steamers from Baltimore make regular landings as far as Snow Hill. The mean rise and fall of tides is about 2.2 feet at the entrance, 2.8 feet at Pocomoke City, and 3 feet at Snow Hill, but is considerably affected by the winds. Freshets cause a rise of 1 to 5 feet at Snow Hill but are not dangerous.

To enter **Pocomoke River**, pass midway between Saxis Pier and the black buoy westward of it and steer north-northeastward for $\frac{1}{2}$ mile, then northeastward for $1\frac{1}{4}$ miles to the red buoy at the western edge of the Muds. Pass northward of this, northward of a red buoy on the end of a shoal extending $\frac{1}{2}$ mile northward from **Pig Point**, southward of a black buoy on the end of a shoal extending $\frac{1}{2}$ mile south-southwestward from **Williams Point**, then steer northeastward, passing close eastward of the black buoy eastward of the end of Williams Point, and follow the shore closely for $\frac{3}{8}$ mile until up with a white house, then gradually work off to midstream where the river contracts. Above the entrance the mid-channel is clear to within 5 miles of Snow Hill.

Shelltown is a post village on the west side of Pocomoke River, 2 miles above Williams Point. There is a store and gasoline is obtainable.

Rehoboth is a post village on the west side, 9 miles above the entrance.

Pocomoke City is a town with railroad communication, 17 miles above the mouth. All kinds of supplies are obtainable, and there is a railway capable of hauling out vessels of 200 tons, 125 feet length, and 7 feet draft. Two bridges cross the river at this point. Both have center pier draws, with openings 64 feet wide in the lower bridge and 62 feet wide in the upper. The best water leads through the western opening in both bridges.

Snow Hill is a town with railroad communication, 25 miles above the mouth of the river. It has considerable trade in streamers and schooners up to 7 feet draft. A fixed bridge having a headroom of 4 feet at high water crosses the river just above the wharves, and the river is navigable for 2 miles above for any boats that can pass under the bridge. The town is connected with Baltimore by steamer.

Marumsco Creek, at the northern end of Pocomoke Sound, $2\frac{1}{2}$ miles north-northeastward of Saxis Pier, has a depth of 2 feet for 1 mile above the mouth and is little used.

East Creek, $2\frac{1}{2}$ miles northward of Saxis Pier, has a depth of 1 to 2 feet and is little used.

Apes Hole Creek, 4 miles west-northwestward of Saxis Pier, has a depth of 2 feet to the head. There are small wharves on the north-west side at which small boats from the north end of Pocomoke Sound make landings for Crisfield, 2 miles northwestward.

Broad Creek, a crooked thoroughfare connecting the north end of Pocomoke Sound with Little Annemessex River, has a depth of $5\frac{1}{2}$ feet in a dredged channel and is extensively used by local boats. There is an oyster house on the east side at the southern entrance and one in mid-channel just inside the entrance. There is a light at each entrance.

DIRECTIONS, POCOMOKE SOUND.

The following directions are good for vessels of 10 feet draft to Tunnel Island Spit light and 7 feet to Saxis Pier:

From southward.—From Old Plantation Flats lighthouse to the entrance of Pocomoke Sound, give the shore a berth of 2 miles or more, and when Watts Island lighthouse (white tower in clump of trees) is made, head for it on a 27° true (NE. by N. mag.) course until $3\frac{1}{2}$ miles from it and $\frac{3}{4}$ mile west-northwestward of buoy No. 2A, on the southeast side at the entrance.

From northward.—Pass westward and $\frac{1}{2}$ mile southward of buoy No. 12 and steer 110° true (SE. by E. $\frac{3}{4}$ E. mag.) for $8\frac{1}{2}$ miles, passing $\frac{3}{4}$ mile southward of buoy No. 1, on the western side at the entrance of Tangier Sound, and to a position $\frac{3}{4}$ mile west-northwestward of buoy No. 2A, on the southeast side at the entrance.

From Pocomoke Sound entrance to Pocomoke River entrance.—From a position $\frac{3}{4}$ mile west-northwestward of buoy No. 2A, steer 60° true (NE. by E. $\frac{7}{8}$ E. mag.) to the black buoy $1\frac{1}{4}$ miles south-southeastward of Watts Island lighthouse, leaving it $\frac{1}{2}$ mile on the port hand; then steer 34° true (NE. $\frac{3}{8}$ N. mag.) for 3 miles to the red buoy westward of Beach Island, leaving it 250 yards on the starboard hand, and then 20° true (NNE. $\frac{3}{8}$ E. mag.) for $1\frac{3}{4}$ miles with a black buoy a little on the port bow. Pass $\frac{1}{4}$ mile eastward of it and steer 4° true (N. $\frac{7}{8}$ E. mag.) to Tunnel Island Spit light.

Pass $\frac{1}{4}$ mile westward of Tunnel Island Spit light, then steer 35° true (NE. $\frac{3}{8}$ mag.); pass 300 yards eastward of buoy No. 7 and continue the course for 1 mile past the buoy. Then steer 60° true (NE. by E. $\frac{7}{8}$ E. mag.) for $3\frac{1}{2}$ miles, with Saxis Pier a little on the starboard bow to a position midway between the pier and the black buoy westward of it. (For directions for entering Pocomoke River see p. 192.)

TANGIER SOUND,

on the eastern side of Chesapeake Bay, with its southern entrance about 48 miles above the entrance to the bay, is 30 miles long and 3 to 5 miles wide. It forms the approach to several important tributaries and is frequented by bay steamers and schooners, the deepest draft being 12 feet and usual draft 6 to 8 feet. It is also frequented

by a large number of boats engaged in the oystering and fishing industry. The sound is separated from Chesapeake Bay by a row of marshy islands and flats, through which several thoroughfares lead.

The main entrance is from southward and is marked by **Tangier Sound lighthouse** (white house on piles) and **Watts Island lighthouse** (white tower). A broad and deep channel leads from the south end to the tributaries at the north end. It is bordered by extensive flats, but the most prominent dangers are marked by buoys and lights, and the channel is easily followed by day with the aid of the charts. In the tributaries local knowledge or a pilot is necessary. The sound is also entered by vessels through **Hooper** and **Kedges Straits** and by small boats from **Pocomoke Sound** through **Broad Creek** and **Little Annemessex River**.

The islands and thoroughfares on the east side from **Watts Island** northward to **Cedar Straits**, are described under "**Pocomoke Sound**."

Tangier Island is low, sparsely wooded in the center, and bare on the north and south ends. A church spire near the center is prominent. There is a village (**Tangier post office**) in the center of the island and several smaller settlements, all composed of people engaged in oystering and fishing. Steamers from **Baltimore** make landings at a detached pier in the center of the cove at the south end of the island, with which there is communication with the shore by small boats. Just northward of the pier are the ruins of a long wharf.

There is a depth of 7 feet at the pier and this depth can be carried to it from anywhere eastward. The usual landing for small boats is on the southwest side of the cove near the center of the island, westward of the large island on the east side. A channel 5 feet deep and 50 feet wide has been dredged from **Tangier Sound** through the cove to **Tangier**. It is entered from northward between **Horseshoe Islet** and a crab house 400 yards westward and leads to an anchorage basin 400 feet square in front of the town. The channel is marked by bush stakes, maintained by private parties, and lighted beacons. Gasoline and provisions are obtainable, and there is communication with **Crisfield** by motor boat and steamer. Near the southern point of the island there is a fish factory and wharf.

The flats between **Tangier Island** and **Smith Island** are usually bare at low water, and there is no thoroughfare through them except for small boats at high water.

Smith Island is the name applied to a large group of marshy islands separated by narrow thoroughfares; none of the islands are connected by bridges, and travel is entirely by boat. **Tylerton**, **Ewall**, and **Rhodes Point** are three small post villages on the island, all on the interior channels. All of the people are engaged in the oystering and fishing industry. There are stores at all of the villages, and gasoline is obtainable.

A draft of 5 feet at low water can be carried from **Tangier Sound** to **Tylerton** from southward. The best water leads across the flats about $1\frac{7}{8}$ miles southward of **Horse Hammock Point** (marked by two shanties). In entering, head for **Herring Island** (marked by three shanties) on a west-southwesterly course until $\frac{1}{2}$ mile from it, then follow the slough northward along **Tylers Creek** to **Tylerton**. The channel is sometimes marked by bush stakes, but is difficult without

local knowledge. A channel has also been dredged 4 feet deep and 25 feet wide from Tangier Sound through **Big Thoroughfare** and **Tylers Ditch** to Tylerton. It is marked by a light and usually by bush stakes but is difficult to follow without local knowledge. There are several thoroughfares, navigable by small boats at high water, leading from the interior of Smith Island westward into Chesapeake Bay, the principal entrance is marked by a light, but local knowledge is necessary to follow them.

Little Annemessex River, on the eastern side of Tangier Sound, 13 miles northward of the entrance, is the approach to the town of **Crisfield**, a railroad terminus and important shipping point for sea food. It is frequented by a large number of boats of 2 to 6 feet draft engaged in the oystering and fishing industry, by steamers from Baltimore drawing 6 to 8 feet, and by some schooners, the deepest draft being 12 feet. A channel has been dredged 12 feet deep and 425 feet wide from the entrance to Somers Cove lighthouse, and the same depth and 266 feet wide to the steamboat wharf, and an anchorage basin with a present depth of 8 feet has been dredged above the steamboat wharf. The channel is marked by lights and buoys and is easily followed. **Janes Island lighthouse**, at the entrance, is a white house on piles. A fish factory and stack on the north point at the entrance are prominent. The mean rise and fall of tides is 1.9 feet.

Directions, Little Annemessex River.—From the perpendicularly striped bell buoy steer 52° true (NE. by E. $\frac{1}{8}$ E. mag.) with Great Point light a very little on the starboard bow, and leave a black buoy about 100 yards on the port hand. Leave Great Point light about 75 yards on the starboard hand, and when past it steer about E. (mag.), keeping buoy No. 4 on the starboard bow; when nearly up to this buoy stand so as to leave it 75 yards on the starboard hand. Then steer 113° true (SE. by E. $\frac{3}{8}$ E. mag.) for $\frac{1}{4}$ mile, and then steer 95° true (E. by S. mag.) with buoy No. 6 (which will be seen southward of Somers Cove lighthouse) a little on the starboard bow; leave this buoy 50 yards on the starboard hand and steer 44° true (NE. $\frac{1}{2}$ E. mag.), so as to leave buoys Nos. 8 and 10 about 50 yards on the starboard hand and buoy No. 5 about 50 yards on the port hand. When abreast of buoy No. 10 head for the end of the steamboat wharf (marked by large freight house).

Anchorage at Crisfield can be had in a depth of 10 feet in the anchorage basin, the western limit being 150 yards westward of the end of the steamboat wharf and 120 yards westward of the end of the ice factory wharf (marked by triple stacks). Small boats make fast to the wharves or anchor anywhere outside the channel. There are depths of 7 to 12 feet in the cove on the south side of the steamboat wharf and 4 to 8 feet in the basin eastward of the drawbridge at the eastern end of the cove, which is considerably used as an anchorage. The bridge has a draw opening 24 feet wide. The river above the wharves at Crisfield has a depth of 2 to 5 feet and is used only as an anchorage for small craft. Gasoline and provisions, and coal in limited quantities, are obtainable, and there is water on the wharves. There is a marine railway capable of hauling out vessels of 125 tons, 6 feet draft, and 100 feet length, and machine shop for ordinary repairs to motors.

Big Annemessex River, on the eastern side of Tangier Sound, 5 miles northward of Janes Island lighthouse, has a depth of 8 feet for $5\frac{1}{2}$

miles above the mouth and 4 feet for a farther distance of 2 miles, above which it is shoal. The river is frequented by small oyster and fishing boats and some schooners, the deepest draft being 8 feet. The mean rise and fall of tides is about 2 feet. **Fords Wharf** is on the north side, at the foot of a road $1\frac{1}{2}$ miles from the post village of **Fairmont**. A depth of 6 feet can be taken to it. Two white buildings on the wharf are prominent. There is a wharf and some oyster and crab packing houses on the south side of **Jones Creek**, and a small village (**Coburn Landing**) on the east side of **Coburn Creek**, where there is a store and gasoline is obtainable.

The entrance to **Big Annemessex River** is marked by a light on the north side and by buoys. There are no marks above the entrance, and shoals make off for a long distance from many of the points. To enter, pass $\frac{3}{8}$ mile southward of the light and steer 90° true (E. $\frac{1}{2}$ S. mag.) for $\frac{3}{4}$ mile to a position midway between buoys Nos. 1 and 2, then steer 77° true (E. $\frac{5}{8}$ N. mag.) for $2\frac{1}{4}$ miles until the white buildings on **Fords Wharf** bear north-northwestward, distant $\frac{1}{2}$ to $\frac{3}{4}$ mile, then bring them astern on a south-southeasterly course and be guided by the chart.

Manokin River, on the eastern side of **Tangier Sound**, 17 miles northward of **Tangier Sound lighthouse** and eastward of **Kedges Straits**, is navigable to **Princess Anne**, a town on the railroad, 14 miles above the main channel of **Tangier Sound**. There are several small villages and landings in the tributaries in the lower end, and this part is frequented by many local fishing and oyster boats. The upper end has some trade in small boats and schooners, the deepest draft being 7 feet. The mean rise and fall of tides is about 2.5 feet.

The entrance is broad, but is obstructed by extensive shoals. The main channel, entering along the southeast side, is narrow and crooked and has ample depth at the entrance, gradually shoaling to 7 feet at **Locust Point**, 9 miles above. It is well marked by bouys and beacons to within 3 miles of **Locust Point**. For a distance of 2 miles above **Locust Point** a channel 6 feet deep and 100 feet wide has been dredged, but is subject to considerable shoaling. The dredged channel is sometimes marked by bush stakes, but leads between mud flats nearly bare at low water and is difficult to follow without local knowledge. From the upper end of the dredged channel the river has a depth of 5 feet or more in mid-channel to **Dashiells Wharf**, $\frac{3}{4}$ mile below **Princess Anne**, above which it is shoal.

Inverness is a post village on the south side of **Manokin River** between **Broad and Wolf Trap Creeks**. **Champ** is a post village a little northward of **Locust Point**.

Little Island Channel, entering **Manokin River** along the northwest side, has ample depth, but a middle ground having a depth of 5 feet must be crossed to reach the main channel of **Manokin River**. It is buoyed but is narrow and crooked, and difficult without local knowledge.

Little Island is low, with oysterhouses on the north end.

Deal Island, on the eastern side of **Tangier Sound** between **Manokin and Wicomico Rivers**, is the center of a considerable oystering and fishing industry. **Deal Island** at the north end and **Wenona** at the south end are post villages. Steamers from **Baltimore** make landings at a long wharf at the north end, which has a depth of 7 feet at the end. The flats between the end of the wharf and the main channel of **Tangier Sound** have depths of 10 to 14 feet and are used as an

anchorage by small local vessels. A light marks the western extremity of the 6-foot curve northwestward of the wharf. The island is connected with the mainland by a fixed bridge. Gasoline and provisions are obtainable at Wenona or Deal Island, and there is a railway at Wenona capable of hauling out boats of 40 tons, 50 feet length, and 5 feet draft.

Lower Thoroughfare, between Little Island and the south end of Deal Island, has been improved by dredging a channel 80 feet wide with a present depth of 5 feet from westward to the wharf at Wenona, widened to 180 feet in the upper $\frac{1}{4}$ mile to form an anchorage. From the entrance buoys the channel leads to buoy No. 3, then east-northeastward, with the oysterhouse on the north end of Little Island a little on the port bow, until 180 yards from the island, and then northward with the wharf a little on the port bow. There is a depth of 1 foot around the northeast end of Little Island.

Laws Thoroughfare, between Deal Island and the mainland, has a depth of 2 feet from southward as far as the cove eastward of the northern end of the island, but navigation from northward is obstructed by a fixed bridge having a headroom of 3 feet at high water and a depth underneath it of 1 foot at low water.

Kedges Straits is described under a separate heading on page 200.

South Marsh, on the north side of Kedges Straits, is a low marsh with scattered clumps of trees and no buildings except a few oyster-houses.

Holland Island is low and sparsely wooded and has a prominent church spire. There is a village on the island composed entirely of oystermen and fishermen. The small wharves on the eastern side can be reached through Holland Straits. There are stores, but supplies are usually obtained from Deal Island, with which there is communication by motor boat.

Holland Straits, leading between Holland and Bloodworth Islands on the west and north and South Marsh on the south, is seldom used all of the way through, but is considerably used by local oyster and fishing boats from both ends as far as Holland Island. The usual draft using it is 2 to 5 feet and the deepest draft 8 feet. It has a depth of 11 feet from southward to abreast Holland Island and 4 feet from Holland Island northward and eastward into Tangier Sound. The channel is narrow in places and unmarked, and is difficult without local knowledge. **Spring Island** is low and marked by a shanty and a single tree on the north end.

Bloodworth Island is a marsh with scattered clumps of trees and has a few oyster and crab houses on the eastern side. There are no prominent marks. The waters surrounding it are frequented by many small local boats.

Wicomico River, emptying into the northeast end of Tangier Sound, is navigable for a distance of 20 miles above the entrance to the town of Salisbury. It is frequented by regular steamers drawing 6 to 8 feet and many freight schooners, the deepest draft being 10 feet. The lower end is also frequented by oyster and fishing boats.

The entrance is $1\frac{1}{2}$ miles wide and is obstructed by extensive shoals, through which a narrow, crooked channel with a least depth of 8 feet leads. It is marked by **Great Shoals lighthouse** (white house on piles) and by lights and buoys as far as Mount Vernon, $7\frac{1}{2}$ miles above its junction with the main channel of Tangier Sound; but the

channel is difficult, and strangers of a deeper draft than 6 feet are advised to take a pilot. Strangers of a less draft can enter with the aid of the chart and the aids. A pilot can be obtained at Deal Island or in the vicinity of the mouth. The mean rise and fall of tides is 2.5 feet at the entrance and 3 feet at Salisbury. The water is fresh above White Haven and can be used in boilers.

To enter Wicomico River, pass 300 yards northward of buoy No. 10 and steer 67° true (ENE. $\frac{1}{2}$ E. mag.), with Great Shoals lighthouse well on the starboard bow, for $3\frac{1}{2}$ miles to buoy No. 2, passing southward of can buoy No. 1A. From buoy No. 2 steer 95° true (E. by S. mag.), with Great Shoals lighthouse a little on the port bow, and round it at a distance of 150 yards; then steer 23° true (NNE. $\frac{5}{8}$ E. mag.) for $\frac{1}{2}$ mile to buoy No. 5, edging to the westward to avoid a 5-foot shoal marked by a beacon. From buoy No. 5 to Mount Vernon the shoals are marked by lighted beacons, and the chart is the best guide to White Haven, where the river narrows.

From Mount Vernon to within 2 miles of Salisbury the river has a depth of 10 feet or more and ample width. From there to Salisbury the channel has been improved by dredging to a depth of 9 feet, with a turning basin of the same depth 360 feet wide and 650 feet long at the upper end. The controlling depth to Salisbury in 1922 was 7.5 feet. There are extensive flats bare at low water between Mount Vernon and Salisbury, but they are covered by marsh grass in summer. Ice usually forms on the river as far down as White Haven. In ordinary winters the channel is usually kept open by the regular steamers, except for short periods of time, but in severe winters it is often closed to navigation for extended periods. Vessels entering Wicomico River encounter strong tidal currents setting across the channel at the mouth of Monie Bay, and in winter heavy ice from it is a source of danger.

Dames Quarter is a post village on the south side of Wicomico River, just inside the mouth.

Monie Bay, a cove on the south side of Wicomico River, just inside the mouth, has a depth of 5 feet in the entrance and 3 feet in mid-channel to the head. It is frequented only by small local boats. Monie and Little Monie Creeks at the head are unimportant.

Mount Vernon is a small village on the south side of Wicomico River, 3 miles above Great Shoals lighthouse. **Mount Vernon Wharf**, at which the steamers land, is $1\frac{1}{2}$ miles east-northeastward of the village.

White Haven is a post village on the north side of Wicomico River, $6\frac{1}{2}$ miles above Great Shoals lighthouse. It has several oyster packing houses and is frequented by many oyster and fishing vessels. Gasoline and provisions are obtainable, and there is a marine railway capable of hauling out vessels of 150 tons, 75 feet length, and 6 feet draft.

Wicomico Creek, on the south side of Wicomico River, $8\frac{1}{2}$ miles above Great Shoals lighthouse, is navigable for small craft for several miles and is sometimes used by motor boats and small schooners to the farm landings. In entering the creek the best water leads northward of a shoal making northward from the south side of the entrance, then southward of an islet in the mouth.

Salisbury, at the head of navigation on Wicomico River, has considerable trade in the regular steamers, and in schooners up to 10 feet draft. The river forks at the south end of the town. The north branch has been dredged 9 feet deep and 100 feet wide to a milldam $\frac{3}{8}$ mile above the fork, with a turning basin at the head. It is crossed by a drawbridge just above the fork having a clear width of 30 feet. The east branch has been dredged by private enterprise, 80 feet wide and 9 feet deep, to the head of navigation $\frac{1}{2}$ mile above the fork. It is crossed by two drawbridges having a least clear width of 40 feet. All kinds of supplies are obtainable at Salisbury, and there is a railway capable of hauling out vessels of 175 tons, 125 feet length, 5 feet draft forward and 10 feet aft, and shops for ordinary repairs to motors. Regulations prescribed for the bridges crossing both forks of the river at Salisbury require that they shall be opened to all vessels unable to pass under them within 3 minutes after a signal of 3 blasts at any time between 6 a. m. and 9.30 p. m., except between 6.30 and 7 a. m., 12 m. and 1 p. m., and 6 and 6.30 p. m., when they will remain closed.

Nanticoke River is described under a separate heading on page 201.

Fishing Bay, at the north end of Tangier Sound, has a depth of 12 feet in a narrow partially marked channel to Fishing Point, 6 miles above the entrance, and 7 feet can be carried anywhere in mid-channel to this point. Above Fishing Point the bay shoals rapidly to 3 feet in the upper end. Elliott is a post village on Fishing Point. A white oysterhouse with iron stack on the end of the point is prominent. Pilots for Fishing Bay and the tributaries at the head can be had at Bishop Head or Fishing Point.

Blackwater River, at the northern end of Fishing Bay, has a depth of about 2 feet at the mouth and deeper water inside. It is said to be navigable for 15 miles or more, and is used by small vessels carrying produce and canned goods.

Transquaking River, emptying into the northern end of Fishing Bay, has a depth of about 2 feet at the entrance and deeper water inside for about 6 miles to a fork. The northern branch is called Transquaking River and the eastern branch **Chicacomico River**; both are said to be navigable for several miles and are frequented by small vessels carrying produce.

Hooper Strait is described under a separate heading on page 203.

DIRECTIONS, TANGIER SOUND FROM SOUTHWARD.

The general direction of the tidal currents is north and south, following the channel and diverging slightly off the entrances of the tributaries and straits. The velocity is greatly influenced by the force and direction of the wind. In the fall and winter long-continued northerly winds may lower the water as much as 2 feet below the normal and this is important to vessels passing through Kedges and Hooper Straits and into Crisfield Harbor.

The following directions will lead in a depth of 15 feet or more to the junction of Nanticoke and Wicomico Rivers:

Entrance to Janes Island lighthouse.—Head for Tangier Sound lighthouse (white house on piles) on any course between 3° true (N. $\frac{7}{8}$ E. mag.) and 45° true (NE. $\frac{1}{2}$ E. mag.). Pass $\frac{1}{4}$ mile eastward of it and steer 14° true (N. by E. $\frac{3}{4}$ E. mag.) for $4\frac{1}{2}$ miles to a position

$\frac{1}{4}$ mile eastward of buoy No. 1C, and then steer 358° true (N. $\frac{3}{8}$ E. mag.) for $2\frac{3}{4}$ miles to a position $\frac{1}{2}$ mile westward of Great Fox Island Shoal bell buoy. Then steer 11° true (N. by E. $\frac{1}{2}$ E. mag.) for $3\frac{7}{8}$ miles, until $\frac{3}{4}$ mile west-northwestward of Janes lighthouse and $\frac{1}{4}$ mile westward of Janes Island Shoal buoy.

Janes Island lighthouse to Sharkfin Shoal lighthouse.—When Janes Island lighthouse bears east-southeastward, distant $\frac{3}{4}$ mile, steer 28° true (NE. by N. mag.) for $2\frac{1}{2}$ miles and leave buoy No. 3 about 500 yards on the port hand. When the buoy is $\frac{1}{2}$ mile distant on the port quarter, steer 327° true (NNW. $\frac{3}{8}$ W. mag.), with Somers Cove lighthouse astern, for 4 miles to a position $\frac{3}{8}$ mile westward of buoy No. 6. From here steer 341° true (N. by W. $\frac{1}{8}$ W. mag.) for 3 miles, to a position $\frac{3}{8}$ mile westward of buoy No. 8, and then steer 0° true (N. $\frac{1}{2}$ E. mag.) for 5 miles, to a position $\frac{1}{2}$ mile westward of buoy No. 10 and $\frac{3}{4}$ mile southeastward of Sharkfin Shoal lighthouse.

KEDGES STRAITS,

connecting Tangier Sound and Chesapeake Bay between Smith Island and South Marsh, has a least depth of 10 feet, and is used by many vessels of 6 to 9 feet draft bound from northward to points on Tangier Sound southward of Manokin River. It is marked by **Holland Island Bar lighthouse** (white house on piles) and **Solomons Lump lighthouse** (white house on pier) and by buoys and is easy of navigation by day with the aid of the chart. The islands adjacent to it are low and present no prominent marks. The mean rise and fall of tides is 1.7 feet, but the range is considerably affected by winds, easterly winds raising the water, and northwesterly winds lowering it sometimes as much as 2 feet below the normal. Floating ice in the winter makes the navigation of the straits dangerous, tugs from Baltimore being often employed to tow local vessels through the ice.

DIRECTIONS, KEDGES STRAITS.

These directions are good for a draft of 9 feet in the daytime when the water is not low.

From southward.—Steer for Holland Island Bar lighthouse on any bearing eastward of 354° true (N. mag.) until Solomons Lump lighthouse bears anything southward of 84° true (E. mag.). Then steer 62° true (ENE. mag.) until Holland Island Bar lighthouse bears 284° true (WNW. $\frac{1}{4}$ W. mag.), passing northward of a black and white perpendicularly striped buoy.

From northward.—Give the islands north of the entrance a berth of 2 miles, and pass at least 1 mile westward of Holland Island Bar lighthouse and $\frac{1}{2}$ mile southward of it, then steer 89° true (E. $\frac{1}{2}$ S. mag.) until Holland Island Bar lighthouse bears 284° true (WNW. $\frac{1}{4}$ W. mag.). When Holland Island Bar lighthouse bears 284° true (WNW. $\frac{1}{4}$ W. mag.), steer 104° true (ESE. $\frac{1}{4}$ E. mag.), keeping it on the bearing astern, and pass 250 yards northward of buoy No. 2, $\frac{1}{4}$ mile northward of Solomons Lump lighthouse, well northward of the horizontally striped buoy northward of the lighthouse, and 250 yards southward of bell buoy No. 1. Continue the course for 3 miles past Solomons Lump lighthouse and 2 miles past bell buoy No. 1, when the vessel will be in the channel of Tangier Sound.

NANTICOKE RIVER,

emptying into the northern end of Tangier Sound, has a depth of 9 feet to the town of Seaford, Del., at the head of navigation 36 miles above the mouth, and has considerable trade in steamers and schooners. The deepest draft entering is 12 feet, and this draft is taken to Seaford at high water. Steamers from Baltimore make landings at the principal wharves as far as Seaford. Ice forms on the river in winter, but in ordinary winters the channel is kept open during most of the time by the regular steamers. Spring freshets do not interfere with navigation. Pilots can be obtained at Deal Island or Roaring Point.

The river from the mouth to **Wetipquin Creek**, a distance of 8 miles, is wide and is obstructed by extensive shoals, most of which are marked by buoys, but some local knowledge is required to keep in the best water. The channel has a least depth of 20 feet for 5 miles to **Ragged Point**. Between **Ragged Point** and **Wetipquin Creek** is an extensive middle ground with channels on either side. The main channel is on the western side and has ample width and a least depth of 9 feet and should be used by strangers. The channel eastward of the middle ground has a depth of 7 feet and is used by the regular steamers but is narrow and difficult.

From the mouth of **Wetipquin Creek** to **Sharptown**, 28 miles above the mouth, the river has ample width and depth and is easily followed, the mid-channel being clear. From **Sharptown** to **Seaford** there is a least depth of 9 feet, and the channel is narrow and difficult in places and is unmarked. For a distance of $1\frac{3}{4}$ miles below **Seaford** a channel has been dredged 9 feet deep and 100 feet wide, with a turning basin at the head. The water is fresh above **Vienna** and can be used in boilers.

Sandy Point, on the west side, at the entrance, is marked by a prominent clump of trees.

Nanticoke is a post village on the east side, $3\frac{1}{2}$ miles above **Clay Island Shoal** light. **Nanticoke Wharf**, on the south side of **Roaring Point** $\frac{3}{4}$ mile from **Nanticoke**, is visited by the regular steamers.

Bivalve is a post village on the east side, $6\frac{1}{2}$ miles above **Clay Island Shoal** light. Steamers drawing 7 feet make landings at the wharf, but there is a shoal westward and northward of it, and local knowledge is necessary to carry this draft to the wharf.

Wetipquin Creek, on the east side, 8 miles above **Clay Island Shoal** light, has been improved by dredging a channel with a present depth of 6 feet and 120 feet wide from **Nanticoke River** to the wharf at the post village of **Tyaskin**, on the south side, just inside the mouth. A turning basin of the same depth has been dredged off the wharf. Gasoline and provisions are obtainable. The channel is sometimes marked by bush stakes. The course in the channel is 136° true (SE. $\frac{5}{8}$ S. mag.), heading for the white buildings on the wharf.

Wetipquin is a post village on the east side of **Nanticoke River**, $11\frac{1}{2}$ miles above **Wetipquin Creek**. **Sandy Hill Landing** is at the foot of the road $\frac{1}{2}$ mile from **Wetipquin**.

Quantico Creek, on the east side, 13 miles above **Clay Island Shoal** light, is shoal at the mouth but is navigable for several miles and used by small boats to the farm landings and mills near the head.

Rewastica Creek, on the east side, just above Quantico Creek, is navigable for small boats for several miles, but is little used.

Vienna is a village and railroad station on the west side, 22 miles above the mouth. A railroad bridge having a center pier draw, each opening 60 feet wide, crosses the river at this point.

Riverton is a post village on the east side, just below the junction of Nanticoke River and Marshyhope Creek.

Marshyhope Creek (northwest fork of Nanticoke River) empties into the river 26 miles above the mouth. It has a depth of 6 feet for 14 miles above the mouth to within $\frac{1}{2}$ mile of the town of **Federalsburg**, the upper $4\frac{1}{4}$ miles having been improved by dredging to a present depth of 5 feet and width of 60 feet, with a turning basin at the head. The creek has some trade in small vessels, the deepest draft being 8 feet. The lower part is easy of navigation, but the upper end is difficult without local knowledge. **Brookview** is a post village 5 miles above the mouth, and there are several other small villages. Two bridges with draw openings 60 feet wide cross the creek between the mouth and Federalsburg.

Sharptown is a town on the east side of Nanticoke River, 28 miles above the mouth. It has several mills and canneries and considerable trade in schooners and steamers. There is a shipyard, and a marine railway capable of hauling out vessels of 1,000 tons, 200 feet length, 7 feet draft forward and 13 feet aft. A bridge having a center pier draw, each opening 75 feet wide with a headroom of 4 feet at high water when closed, crosses the river at Sharptown.

Broad Creek, emptying into Nanticoke River from eastward $3\frac{1}{2}$ miles above Sharptown, has been improved by dredging a channel with a present depth of $5\frac{1}{2}$ feet and 70 feet wide to the head of navigation at **Laurel**, a town on the railroad $6\frac{1}{2}$ miles above the mouth. Laurel has several mills and considerable trade in schooners and other vessels, the deepest draft being 9 feet. A railroad bridge, having a draw opening 40 feet wide and a height of about 21 feet when closed, crosses the creek at the lower end of the town. The dredged channel extends 230 yards above the railroad bridge, and small boats can go to a milldam $\frac{1}{4}$ mile above.

Bethel is a village on Broad Creek, $2\frac{1}{2}$ miles below Laurel. It has a marine railway capable of hauling out vessels of 100 tons and 6 feet draft. A highway bridge having a draw opening 58 feet wide crosses the river at Bethel.

Seaford is a town on Nanticoke River, 36 miles above the mouth. It has several mills and canneries and considerable trade in steamers and schooners, the deepest draft being 12 feet. A railroad drawbridge, having a center-pier draw with one opening 60 feet wide and a headroom of 4 feet at high water when closed, crosses the river near the lower end of the town. There is a strong cross current through the bridge. The dredged channel extends for 600 yards above the railroad bridge to a highway drawbridge having a single opening 30 feet wide. There is a depth of about 7 feet for $1\frac{1}{2}$ miles above the highway bridge, and small boats can go to a milldam about 5 miles above the bridge, but there is little business above Seaford. There are marine railways at Seaford, the largest capable of hauling out vessels of 400 tons, 12 feet draft, and 200 feet length. Gasoline and provisions are obtainable and there is water on the wharves.

Tides.—The mean rise and fall of tides is 2.5 feet at the entrance, 3 feet at Vienna, 2.6 feet in Marshyhope Creek, 3 feet at Laurel, and 3.4 feet at Seaford.

HOOPER STRAIT,

the most northerly entrance to Tangier Sound, leads between Hooper Island and **Bishop Head** on the north and Bloodworth Island on the south. It is used by all of the vessels from northward to the tributaries in the north end of Tangier Sound. It has a depth of 12 feet in a narrow, crooked channel, but there are shoals with little depth close to it, and it is seldom used by vessels of a greater draft than 9 feet, the deepest draft usually passing through at high water. It is marked by Hooper Strait and Sharkfin Shoal lighthouses and by buoys, and strangers should be able to enter in the daytime by following the directions closely. The mean rise and fall of tides is 1.7 feet at Hooper Strait lighthouse and 2.2 feet at Sharkfin Shoal lighthouse. The tidal currents have considerable velocity, and in winter sailing vessels are in danger from running ice.

DIRECTIONS, HOOPER STRAIT.

From southward.—From a position 1 mile southeastward of Point Lookout lighthouse, make good a 37° true (NE. $\frac{1}{8}$ N. mag.) course for 14 miles. Or, from a position $2\frac{1}{2}$ miles westward of Holland Island Bar lighthouse, make good a 7° true (N. by E. $\frac{1}{8}$ E. mag.) course for about 9 miles. Or, from the red buoy 5 miles westward of Holland Island Bar lighthouse, make good a 27° true (NE. by N. mag.) course for $9\frac{1}{2}$ miles. Or, with Point No Point lighthouse bearing 236° true (SW. by W. $\frac{1}{2}$ W. mag.), steer 56° true (NE. by E. $\frac{1}{2}$ E. mag.) about 9 miles from the lighthouse. When Hooper Strait lighthouse bears 73° true (E. by N. mag.) steer for it.

From northward.—Standing down the bay, pass $\frac{3}{4}$ mile westward and southwestward of Hooper Island lighthouse, and steer 118° true (SE. by E. mag.) for 5 miles until Hooper Strait lighthouse bears 73° true (E. by N. mag.).

When Hooper Strait lighthouse bears 73° true (E. by N. mag.), steer for it on this bearing, giving the southern end of Hooper Island a berth of over $\frac{3}{4}$ mile and leaving a red buoy $\frac{3}{8}$ mile on the starboard hand. Pass 300 yards southward of the lighthouse and steer 115° true (SE. by E. $\frac{1}{4}$ E. mag.) for 1 mile to buoy No. 4. Leave it about 250 yards on the starboard hand and steer 126° true (SE. $\frac{1}{4}$ E. mag.), passing 200 yards southward of a bell buoy. From this buoy steer 61° true (ENE. mag.) for $1\frac{5}{8}$ miles, passing northward of two red buoys; from the second buoy steer 99° true (ESE. $\frac{5}{8}$ E. mag.) for 1 mile to a horizontally striped buoy, passing northward of it. From this buoy a southeasterly course for $\frac{3}{4}$ mile will lead to the main channel of Tangier Sound.

HONGA RIVER TO LITTLE CHOPTANK RIVER.

Honga River, on the eastern side of Chesapeake Bay, north of the western end of Hooper Strait, has a depth of 18 feet in a narrow crooked channel, marked by lights and buoys, for 11 miles above the

mouth, above which it shoals rapidly to a depth of 2 to 4 feet at the head. Light-draft vessels should have no trouble in going to the head of the buoyed channel with the aid of the chart. It is frequented by regular steamers in the lower end and local oyster and produce boats to the head, the deepest draft being 8 feet. The mean rise and fall of tides at the entrance is 1.6 feet.

Fox Creek, on the eastern side of Honga River, 3 miles above the mouth, has a depth of 8 feet to **Wingate Point Wharf**, at which steamers from Baltimore land. The channel is marked by a light at the entrance, a buoy in the point of shoal off Paul Point, and sometimes by bush stakes maintained by the steamboat company. **Wingate** is a post village 1 mile from the wharf.

Hooper Island consists of a row of three low islands separating Honga River from Chesapeake Bay. The islands are connected with the mainland and with each other by highway bridges, the two northern bridges having draw openings, and the southern one being fixed. **Applegarth** is a post village at the southern end. **Hoopersville** is a post village near the center of the middle island; steamers from Baltimore drawing 7 feet make landings at the wharf. The thoroughfare between the northern and middle islands is crossed by a drawbridge, and is navigable by small boats at low water.

Fishing Creek is a post village near the center of the northern island.

Tar Bay is a shallow bay between **Barren Island** and the northern end of **Hooper Island**. A very narrow, crooked channel leads from Chesapeake Bay across Tar Bay northward of Barren Island, and through Fishing Creek into the northern end of Honga River. It has a depth of about 4 feet, is marked by two lights and by bush stakes, and is considerably used by small local craft, but local knowledge is necessary to follow it. The lights form a range for the approach, and in entering the first is left to starboard and the second to port. Fishing Creek is crossed by a drawbridge.

Golden Hill is a post village at the northern end of Honga River, and can be reached by boats of 2 feet draft at low water.

A draft of 3 or 4 feet at high water can be carried from the northern end of Honga River through **Great Marsh Creek**, **Lower Keene Broad**, and **Upper Keene Broad** into Slaughter Creek, a tributary of Little Choptank River, but the passage should not be attempted by strangers. It is crossed by two fixed bridges having a headroom of about 4 feet at high water. This thoroughfare can be entered from Chesapeake Bay through a narrow thoroughfare about 3 miles northward of the northern end of Tar Bay; the entrance has a depth of about 3 feet at high water and is crossed by a fixed bridge having a headroom of about 4 feet at high water.

LITTLE CHOPTANK RIVER,

on the eastern side of Chesapeake Bay, $4\frac{1}{2}$ miles southward of Sharps Island, is frequented by steamers from Baltimore and many local boats, the deepest draft being 9 feet. The river is obstructed by shoals but has a depth of 14 feet in a narrow, crooked channel for 8 miles above the mouth and 6 feet for a considerable distance into most of the tributaries. Some of the shoals are marked by buoys, but strangers may have trouble in taking a greater draft than 6 feet above the mouth of Slaughter Creek. The channels in the principal

tributaries are usually marked by bush stakes, but are narrow and crooked and difficult without local knowledge.

Oyster Creek, on the south side of Little Choptank River, just inside the entrance, has a depth of 3 feet in mid-channel to near the head but is little used. There is a depth of 1 foot at low water through the thoroughfare between **James Island** and the mainland. **James Island** is subject to rapid erosion.

Slaughter Creek, on the south side of Little Choptank River, has been improved by dredging a channel 7 feet deep and 100 feet wide across the bar at the entrance and has a depth of 6 feet in a narrow channel to the post village of **Taylor Island**, $2\frac{1}{2}$ miles above the entrance, where there are two wharves. It is used by regular steamers and schooners up to $7\frac{1}{2}$ feet draft. The dredged channel is marked by buoys and by bush stakes maintained by the steamboat company. There are also bush stakes above the entrance, but local knowledge is required to keep in the channel. A drawbridge having a clear opening 25 feet wide crosses the creek at **Taylor Island**; the creek shoals rapidly above the bridge, though small boats can pass through into **Honga River** at high water (see p. 204). Gasoline, water, and provisions are obtainable at **Taylor Island**.

Brooks Creek, on the north side of Little Choptank River, has a depth of 6 feet in a narrow, unmarked channel to within $\frac{3}{4}$ mile of the head. It is frequented only by small local craft.

Hudson Creek, on the north side of Little Choptank River, $6\frac{1}{2}$ miles above the entrance, has a depth of 7 feet to near the head. Regular steamers drawing 6 feet go to **Speddens Wharf** near the head, $\frac{1}{2}$ mile from the post village of **Hudson**. The channel is generally marked by bush stakes but is difficult without local knowledge. Gasoline, water, and provisions may be obtained at **Speddens Wharf**.

Madison Bay, on the southeast side, opposite **Hudson Creek**, has general depths of 6 to 8 feet and about 2 feet to the post village of **Madison** at the head, where there is a wharf with a depth of 5 feet. Gasoline can be obtained at the village.

Fishing Creek, on the south side of Little Choptank River, 8 miles above the entrance, has a depth of 6 feet in a narrow channel for 4 miles above the mouth. There are no wharves on the creek, but it is extensively used by boats bound to **Church Creek**, the principal tributary. The channel is marked by buoys and bush stakes.

Church Creek, emptying into **Fishing Creek**, $2\frac{1}{2}$ miles above the entrance, has a depth of 7 feet to **Milton Wharf**, near the post village of **Woolford**, $1\frac{1}{2}$ miles above the mouth, and 3 feet for a farther distance of $\frac{1}{2}$ mile to the foot of a road $\frac{1}{2}$ mile from the post village of **Church Creek**. It is used by regular steamers and schooners of 6 feet draft as far as **Milton Wharf**. Gasoline and provisions may be obtained at **Milton Wharf** and **Church Creek**.

Phillips, Beckwiths, Carey, and Lees Creeks, tributaries of Little Choptank River above the entrance of **Fishing Creek**, have no commercial wharves and little business by water except in small local boats.

Anchorage.—There is good anchorage in a depth of 12 to 18 feet in the bight between **James Island** and **Hooper Point** if the shores be given a berth of $\frac{1}{2}$ mile or more.

Tides.—The mean rise and fall of tides in Little Choptank River is 1.5 feet.

Directions, Little Choptank River.—To enter from southward, pass westward of buoy No. 16F and steer north-northeastward for Sharps Island until $\frac{1}{2}$ mile westward of James Point Shoal buoy No. 2, keeping outside of the 4-fathom curve to avoid an area of possible fish traps. Pass close northward of buoy No. 2 and steer 114° true (SE. by E. $\frac{1}{4}$ E. mag.) to buoy No. 4. Pass northward and well eastward of it and steer southward to buoy No. 3. Give it a good berth and steer southeastward, being guided by the chart, or take a pilot.

Vessels entering Little Choptank River from northward usually pass eastward of Sharps Island. To enter, follow the directions for entering Choptank River from northward to Blackwalnut Point Shoal gas buoy, then bring it astern on a 180° true (S. $\frac{5}{8}$ W. mag.) course to the black buoy, $1\frac{1}{4}$ miles westward of Hills Point, passing close westward of the red buoy marking a middle ground east of Sharps Island. Then steer 129° true (SE. mag.) for 2 miles to buoy No. 4, passing southward of a black bell buoy. Then follow the directions in the preceding paragraph.

CHOPTANK RIVER,

on the eastern side of Chesapeake Bay, 102 miles above the entrance and 43 miles below Baltimore, is navigable for a distance of 55 miles above the entrance, to the town of Greensboro. The river and its tributaries are frequented by many oyster and fishing boats and steamers and schooners engaged in the bay trade, the usual draft of boats being 5 to 8 feet and the deepest draft 15 feet.

Channels.—The main entrance to Choptank River leads southward and eastward of Sharps Island. It has a least depth of 28 feet and is broad and easy of access. The channel northward of Sharps Island lighthouse has a least depth of 16 feet and is used by all vessels from northward bound to or from Choptank or Little Choptank Rivers. The northern entrance is marked by buoys and lights, but should not be entered by strangers of a greater draft than 12 feet.

The main channel of Choptank River has a depth of 25 feet to Cambridge, 17 miles above Sharps Island, 12 feet for a further distance of 28 miles to within 3 miles of the town of Denton, and 8 feet to Denton. From Denton to Greensboro, 7 miles above, the river has been improved by dredging a channel with a present depth of 7 feet and 75 feet wide.

Steamers from Baltimore make regular landings at all the principal wharves on the river as far as Windy Hill, 30 miles above the mouth, and at landings in Tred Avon River and La Trappe and Tuckahoe Creeks. There is railroad communication at Oxford, Easton, Cambridge, Denton, Greensboro, and Hillsboro.

Sharps Island, a low island marked by a single tree, lies in Chesapeake Bay off the entrance, and Sharps Island lighthouse (brown tower on pier), 1 mile north-northwestward of Sharps Island, is the principal guide to the entrance. The island is subject to rapid erosion.

Tilghman Island, on the north side of the entrance to Choptank River, is the center of a large oystering, crabbing, and fishing industry. There are three post villages on the island—**Fairbank**, near the southern end, and **Avalon** and **Tilghman**, near the northern end. The

western side is subject to rapid erosion. **Blackwalnut Cove**, at the southern end of Tilghman Island, has a general depth of 2 feet to Fairbank at the head and is extensively used as an anchorage by small craft.

Tilghman Island Harbor, on the eastern side of the island, has a depth of 10 feet to the steamboat wharf at Avalon and 5 to 8 feet between the steamboat wharf and the oyster-packing wharf 400 yards northward of it. Steamers from Baltimore drawing 8 feet make regular trips to the wharf, and the harbor is also frequented by many local boats of 3 to 7 feet draft. The approach to the steamboat wharf is marked by buoys, lights, and by a privately maintained lighted range on the wharf exhibited on steamer nights. In entering, leave buoy No. 1, 100 to 400 yards on the port side, buoy No. 2 (light marks 6-foot spot northward), 80 yards on the starboard side, then head for the end of the wharf. Gasoline, water, and provisions may be obtained at Tilghman, and there is a railway at Knapps Narrows of 20 tons capacity.

Knapps Narrows, at the northern end of Tilghman Island, has a depth of 3 feet at high water. The channel is usually marked by bush stakes but is difficult without local knowledge. It is crossed by a fixed bridge having a headroom of 4 feet at high water.

Harris Creek, on the north side of Choptank River, just inside the entrance, has a depth of 12 feet in a narrow, crooked channel for $5\frac{1}{2}$ miles above the mouth, 6 feet for a further distance of 2 miles, and 1 foot to **McDaniel** railroad station at the head. It is frequented by oyster and produce boats and small craft bound to the railroad station at McDaniel. The channel is marked by buoys for 3 miles above the mouth, above which the mid-channel is clear if the points be given a good berth. **Sherwood** is a post village on the west side, 4 miles above the entrance.

Trippe Bay, on the south side of the entrance to Choptank River, $4\frac{1}{2}$ miles east-southeastward of Sharps Island, is shoal and little used, except by small oyster and fishing boats.

Broad Creek, on the north side of Choptank River, 7 miles northeastward of Sharps Island, has a depth of 18 feet for 5 miles above the mouth and 6 feet to near the heads of most of the tributaries. There is a depth of 3 feet to **St. Michaels**, a town with railroad communication and with its main water front on Miles River. The creek is frequented only by local oyster and produce boats and boats bound to St. Michaels. The channel is marked by buoys at the entrance, and some local knowledge is required to keep in the best water above. **Balls Creek**, on the west side, just inside the entrance, has a depth of 6 feet to the head; the entrance is narrow and is usually marked with posts and barrels on each side. **Neavitt Wharf** is on the south side, just inside the entrance, and **Neavitt** is a post village at the head.

Irish Creek, just eastward of the entrance to Broad Creek, has a depth of 8 feet in the entrance and 6 feet to near the head. The entrance is narrow and is usually marked by bush stakes, but is difficult without local knowledge. The creek is frequented only by small local craft.

Tred Avon River, on the north side of Choptank River, 9 miles above Sharps Island, has a depth of 16 feet for 5 miles above the mouth and 12 feet for a further distance of 2 miles, above which it has been im-

proved by dredging a channel 8 feet deep and 150 feet wide to **Easton Point**, 1 mile from the town of **Easton**. Steamers from Baltimore drawing 8 feet make regular trips as far as Easton Point, and many schooners and motor boats also frequent the river. **Choptank River lighthouse** (white house on piles) is in mid-channel off the entrance. A draft of 12 feet at low water can be taken into the entrance on either side of the lighthouse by giving it a berth of 400 yards or more, but the channel eastward of the lighthouse is the wider and deeper. There are no marks above the entrance except bush stakes maintained by the steamboat company, and the channel in the upper end is difficult without local knowledge.

Oxford is a town on the east side of Tred Avon River, $1\frac{1}{2}$ miles above the entrance. There is a depth of 15 feet at the wharves on the north side of the town and 6 to 9 feet at the railroad wharf at the south end. The town has railroad communication. Storm warnings are displayed here. **Town Creek**, on the eastern side of Oxford, has a depth of 8 feet in midchannel for $\frac{1}{4}$ mile above the entrance and is extensively used as an anchorage by local craft. There is a railway on the creek capable of hauling out boats of 3 feet draft forward and 5 feet aft. Gasoline may be had in Town Creek.

Bellevue is a village on the west side of Tred Avon River, $\frac{3}{4}$ mile northward of Oxford. Several oyster-packing houses are prominent. There is a depth of 8 feet at the wharf.

Double Mills is a landing on the western side, 3 miles above Oxford.

Island Creek, $1\frac{1}{4}$ miles eastward of Choptank River lighthouse, has a depth of 6 feet in a narrow unmarked channel through the entrance, and this depth can be taken to near the head. The best water favors the eastern side at the entrance.

Lecomptes Bay, on the south side of Choptank River, 3 miles above Choptank River lighthouse, has a depth of 8 feet to **Travers Wharf**, a steamer landing at the south end. The point on the west side at the entrance is marked by a water tank and buildings.

La Trappe Creek, on the north side of Choptank River, $3\frac{1}{2}$ miles above Choptank River lighthouse, has been improved by dredging a channel 11 feet deep and 150 feet wide across the bar at the entrance and 8 feet deep and 75 feet wide to the head of navigation at **Trappe Landing**, 3 miles above the mouth, with a turning basin at the head. It is frequented by regular steamers and schooners up to 9 feet draft. The channel is marked by two lights at the entrance. In entering, leave the outer light 100 feet on the port side, the inner light 100 feet on the starboard side, then follow a mid-channel course to the head. **Trappe** is a post village $1\frac{1}{2}$ miles from Trappe Landing.

Dickinsons Bay, just eastward of **Howells Point**, which is marked by a light, has depths of 3 to 5 feet and is little used.

Cambridge, a town on the south side of Choptank River, 17 miles above the mouth, has considerable trade in bay steamers and schooners and is the center of a large oystering and fishing industry. The deepest draft going to the town is 13 feet.

Cambridge Harbor is a creek $\frac{2}{3}$ mile long on the eastern side of the town. A channel has been dredged to a depth of 12 feet from Choptank River to the railroad wharf on the eastern side of the harbor, 400 yards above the entrance to the creek. The width is 150 feet,

widened to 400 feet abreast the steamboat wharf on the western side of the entrance to the creek. The entire area of the creek outside the 12-foot channel has been dredged to a depth of 8 feet as far as a drawbridge just above the railroad wharf, and a channel of this depth has been dredged for 600 yards above the bridge. The bridge is a center-pier draw, each opening 45 feet wide, with a headroom of 5 feet at high water when closed. The entire harbor is considerably congested by small boats during the oyster season.

The channel into Cambridge Harbor is marked by buoys and a lighted range. There is a strong current across the channel on both ebb and flood. To enter, bring the bell buoy astern on a 245° true (WSW. $\frac{3}{8}$ W. mag.) course, following the range to the steamboat wharf (marked by red wharf house). The front range is on a white box and is plainly visible by day a little to the left of the steamboat wharf, but the rear range is not conspicuous by day. Pass 50 yards southeastward of the steamboat wharf and enter the creek in mid-channel.

Bolingbroke Creek, on the north side of Choptank River, $1\frac{3}{4}$ miles eastward of Cambridge, has a depth of 3 feet across the bar at the mouth and 6 feet inside to the head. There are no wharves except for small boats.

Warwick River, on the east side of Choptank River, 5 miles above Cambridge, has been improved by dredging a channel 10 feet deep and 100 feet wide from Choptank River to **Secretary Landing**, a post village at the head of navigation, 1 mile above the mouth, and had a depth of 10 feet in 1922. It is frequented by many local craft and by regular steamers of 8 feet draft. There is a black buoy on the north side of the entrance and bush stakes further in, but the channel is difficult without local knowledge.

Cabin Creek, on the east side of Choptank River, 7 miles above Cambridge, has a depth of 6 feet for $\frac{3}{4}$ mile above the mouth and 2 feet for a further distance of $\frac{3}{4}$ mile. There are no wharves, and it is frequented only by a few grain schooners and small local craft.

Hunting Creek, on the east side of Choptank River, just below the village of Choptank, has a depth of 4 feet in the entrance and about 2 feet to near the village of **Ellwood**, $2\frac{1}{2}$ miles above the entrance. It is little used.

Choptank is a village on the east side of Choptank River, $10\frac{1}{2}$ miles above Cambridge. It is visited by steamers from Baltimore and schooners, the deepest draft being 10 feet. **Windy Hill** is a steamboat landing on the west side of the river, 1 mile above Choptank.

A railroad bridge, having a center-pier draw with one clear opening 60 feet wide, crosses the river 7 miles above Choptank. A highway bridge having a center-pier draw, each opening 60 feet wide, with a headroom of 3 feet at high water when closed, crosses the river $\frac{3}{4}$ mile above; the eastern opening is the one generally used. **Dover Bridge** is a steamboat landing on the west side, just below the highway bridge.

Tuckahoe River, on the west side of Choptank River, 41 miles above the mouth, has a depth of 8 feet to **Waymans Wharf**, $8\frac{1}{2}$ miles above the entrance. The channel from Waymans Wharf to **Rolphs Landing**, 1 mile above, has been improved by dredging to a depth of 8 feet and width of 50 feet, with a present depth of 6 feet, and there

is a depth of about 1 foot at low water and 3 feet at high water to Hillsboro, a town on the railroad $1\frac{3}{4}$ miles above Rolphs Landing. There is very little business on the river. The channel is not marked and is crooked and difficult in places without local knowledge. The flats are covered with marsh grass in summer. A highway bridge having a single draw opening 39.6 feet wide crosses the creek 1 mile above the entrance.

Two Johns and Williston are small settlements on the east side of Choptank River, $1\frac{3}{4}$ and $2\frac{1}{4}$ miles, respectively, above Tuckahoe Creek.

Denton is a town on the east side of Choptank River, 48 miles above the mouth. There is a depth of 8 feet to the town, and the deepest draft going to it is 9 feet. West Denton is on the west side of the river opposite Denton, and all of the wharves are on that side. Two drawbridges cross the river at Denton; the lower, a highway bridge, has a single lift opening 50 feet wide and 4 feet headroom at high water, and the upper, a railroad bridge, has a center-pier draw, both openings about 50 feet wide, with a headroom of 4 feet at high water.

Greensboro is a town at the head of navigation 7 miles above Denton. It has very little trade at present by water.

Pilots.—There are no regular pilots for Choptank River, but a pilot for the lower end of the river or the tributaries can be obtained from Tilghman Island, and for the upper end from Cambridge. Pilots for the tributaries can also usually be obtained near their entrances.

Supplies.—Coal and water can be obtained on the wharves at Cambridge and coal in limited quantities at Oxford and Denton. Gasoline and provisions are obtainable at Tilghman Island, Oxford, Cambridge, Secretary Landing, Choptank, Denton, and Greensboro, and there are stores at several other places where some supplies are obtainable.

Repairs.—There are machine shops at Cambridge and several railways, the largest capable of hauling out vessels of 150 tons, 100 feet length, 4 feet draft forward and 7 feet aft. There is a railway at Oxford for hauling out vessels of 150 tons, 90 feet length, 3 feet draft forward and 5 feet aft.

Tides.—The mean rise and fall of tides is 1.3 feet at the entrance, 1.9 feet at Cambridge, and 2.5 feet at Denton. The water is fresh above Choptank and can be used in boilers.

DIRECTIONS, CHOPTANK RIVER.

The western limit of fish traps on the eastern side of the bay between Bloody Point Bar lighthouse and the southern end of Hooper Island is the 5-fathom curve. A lane approximately $\frac{1}{2}$ mile wide at the inner end and $\frac{3}{4}$ mile at the outer end is kept clear of fish traps in the channel leading northward of Sharps Island; the northeastern limit is a line from buoy No. 1 to Blackwalnut Point Shoal gas buoy, and the southwestern limit is a line leading to Sharps Island Northeast Shoal buoy (horizontally striped) on a 137° true (SE. $\frac{3}{4}$ S. mag.) bearing. The deepest draft that can be safely taken into the entrance through this lane is 10 feet. Between the entrance to Little Choptank River and Cooks Point, the western limit

of fish traps is a line drawn from the black buoy $1\frac{1}{4}$ miles westward of Hills Point to the red buoy $1\frac{1}{4}$ miles southeastward of Sharps Island, thence to buoy No. 1B, eastward of Blackwalnut Point. The southern limit between the entrances of Harris Creek and Tred Avon River is the 21-foot curve.

The channel is marked by buoys and lights from the mouth to the town of Choptank, $27\frac{1}{2}$ miles above, and is easily followed with the aid of the chart. There are no marks above Choptank, but the mid-channel is clear to the mouth of Tuckahoe Creek, and the channel is easily followed if the points be given a good berth. Between the mouth of Tuckahoe Creek and Greensboro the channel is narrow and crooked and is difficult without local knowledge.

The following directions are for vessels of 12 feet draft to Cambridge. Vessels of a deeper draft should take a pilot. If bound above Cambridge, take a pilot or be guided by the chart.

From southward.—From Sharps Island gas and bell buoy steer 50° true (NE. by E. mag.) to the red buoy on the middle ground eastward of Sharps Island, passing eastward of Sharps Island south end buoy. Pass close westward of the middle ground buoy and steer 32° true (NE. $\frac{1}{2}$ N. mag.), with Cooks Point Shoal bell buoy well on the starboard bow, and pass $\frac{1}{2}$ mile westward and $\frac{1}{4}$ mile northward of it; the black buoy 2 miles east-southeastward of Blackwalnut Point is ahead on this course.

From northward.—From Poplar Island Shoal gas and bell buoy, steer 159° true (S. by E. $\frac{1}{4}$ E. mag.), with Sharps Island lighthouse ahead until $1\frac{1}{4}$ miles from it, then steer 117° true (SE. by E. mag.), leaving Sharps Island lighthouse $\frac{3}{4}$ mile on the starboard hand to a position 300 yards southward of Blackwalnut Point Shoal gas buoy; the outer $1\frac{1}{4}$ miles of this course leads across an area of possible fish traps. Then steer 71° true (ENE. $\frac{7}{8}$ E. mag.) for 2 miles to a position $\frac{1}{4}$ mile northward of Cooks Point Shoal bell buoy.

Cooks Point to Cambridge.—From Cooks Point Shoal buoy, steer 86° true (E. $\frac{1}{4}$ S. mag.) for Choptank River lighthouse until $\frac{5}{8}$ mile from it, then steer 123° true (SE. $\frac{1}{2}$ E. mag.) for 3 miles, leaving the lighthouse $\frac{3}{8}$ mile on the port hand, the red buoys off Castlehaven 250 yards on the starboard hand and continuing the course for 1 mile past the last buoy. Then bring Chlora Point astern on a 152° true (S. by E. $\frac{7}{8}$ E. mag.) course for $1\frac{1}{2}$ miles, passing westward of the black buoy $\frac{3}{4}$ mile northwestward of Howells Point, and continuing the course for $\frac{1}{2}$ mile past the buoy until the end of Horn Point bears 281° true (WNW. $\frac{3}{8}$ W. mag.). Then bring it astern on a 101° true (ESE. $\frac{3}{8}$ E. mag.) course to the black buoy southeastward of Howells Point, passing $\frac{3}{8}$ mile southward of Howells Point light. Pass southward of the black buoy and steer 97° true (ESE. $\frac{3}{4}$ E. mag.) to a position 300 yards north-northeastward of Hambrooks Bar light; from here a 139° true (SE. by S. mag.) course will lead eastward of the red buoy eastward of Hambrooks Bar and to the bell buoy at the entrance of the channel to Cambridge. Anchorage can be had in the channel or on the flats off the town.

EASTERN BAY AND MILES RIVER.

Eastern Bay, on the eastern side of Chesapeake Bay, 34 miles below Baltimore, is the approach to Miles River and several less important

tributaries and to the towns of Claiborne and St. Michaels. It is frequented by a large number of oyster and fishing boats and schooners carrying grain and produce. Regular steamers go to Claiborne, just inside the entrance. The deepest draft of boats entering the bay is 13 feet, and this draft is taken above St. Michaels.

The bay is obstructed by extensive shoals, but a broad channel with a least depth of 30 feet leads through it to the mouths of most of the tributaries. The channel is well marked by buoys and lights through Eastern Bay and Miles River to a drawbridge $5\frac{1}{2}$ miles above St. Michaels, and strangers should have little trouble in following the channel with the aid of the chart to near the bridge. The other tributaries are not well marked and are seldom entered by strangers except in small craft. The shores are low and present no prominent marks. Pilots for Eastern Bay and tributaries can be obtained from Claiborne, or from local boats which can always be found working in the bay.

The main entrance to Eastern Bay, between the south end of Kent Island and Poplar Island, has a broad and unobstructed channel with ample depth. **Bloody Point Bar** lighthouse (brown cylindrical tower) is the principal guide to the entrance. Vessels of 6 feet draft can also enter through Poplar Island Narrows and boats of $3\frac{1}{2}$ feet draft at high water through Kent Island Narrows.

Poplar Island, on the south side of the main entrance to Eastern Bay, is low and sparsely wooded and has no prominent marks. Poplar Island Harbor, on the eastern side, has a depth of 5 feet in the entrance, and there is secure anchorage inside in a depth of 3 to 7 feet.

Poplar Island Narrows, between Poplar Island and the mainland, has a depth of 9 feet, but there are unmarked shoals with little depth close to the channel, and 6 feet is the deepest draft using it. To enter, give the western side of Tilghman Island a berth of $\frac{5}{8}$ mile to Poplar Island Narrows light, pass 250 yards eastward of it and steer 7° true (N. by E. $\frac{1}{4}$ E. mag.) to a position $\frac{1}{4}$ mile westward of the horizontally striped buoy off Haddaway Cove, then steer north-northeastward, giving the eastern shore a berth of at least $\frac{1}{2}$ mile to Claiborne.

Haddaway Cove, 2 miles eastward of Poplar Island, has a depth of 6 feet in mid-channel to **Lows Wharf** at the head. Steamers from Baltimore drawing 6 feet make regular trips to Lows Wharf, and the cove is extensively used as an anchorage by local craft. To enter, pass 100 yards southward of the horizontally striped buoy on the north side of the entrance and steer for the end of the wharf on a 96° true (ESE. $\frac{7}{8}$ E. mag.) course. **Sherwood** is a post village $\frac{1}{2}$ mile from the wharf.

Claiborne is a village and summer resort on the southeast side of Eastern Bay, 5 miles eastward of Bloody Point Bar lighthouse. It is the terminus of a railroad to Ocean City, Md., and intermediate points; steamers from Baltimore and Annapolis make connections with the trains. There is a railroad pier extending 800 feet west-southwestward from the shore and a jetty extending 750 feet west-southwestward from the end of the pier. A channel has been dredged 12 feet deep and 300 feet wide, east-northeastward along the south side of the jetty to the end of the pier, and 12 feet deep and

195 feet wide along the south side of the pier for a distance of 500 feet from the end; in 1923 there was a depth of 11 feet to the head of the channel. There is a short wharf 250 feet southward of the railroad pier, to which a privately dredged channel 10 feet deep leads. Gasoline and provisions are obtainable and there is water on the wharf.

In entering, pass northward and eastward of buoy No. 2A and steer southeastward to the lighted beacon. Pass 75 feet westward and southward of this and steer east-northeastward for the end of the pier.

Cox Creek, on the north side of Eastern Bay and the southeast side of Kent Island, has a depth of 10 feet for 5 miles above **Long Point** on the western side at the entrance and 6 feet for some distance into the three tributaries at the head. It is frequented by oyster boats and schooners carrying produce and grain, the deepest draft being 8 feet. There are several farm landings but no villages. The shoals are unmarked and local knowledge is required to avoid them.

Crab Alley Bay, on the north side of Eastern Bay, $2\frac{1}{2}$ miles northward of Tilghmans Point, has a depth of 21 feet into the entrance and 6 feet to near the head of navigation in both branches. The shoals are unmarked and local knowledge is required to avoid them. **Bodkin Island**, on the western side, is thickly wooded and has no buildings visible. **Parsons Island**, on the eastern side, is sparsely wooded, giving it a ragged appearance, and has an unpainted barn showing clear of the woods and a white house visible at times.

Kent Island Narrows, a narrow slough connecting the northern end of Eastern Bay with Chester River between Kent Island and the mainland, has a depth of $2\frac{1}{2}$ feet at low water and is extensively used by local craft up to $3\frac{1}{2}$ feet draft. It is crossed by two drawbridges—a railroad bridge having a single clear opening 38 feet wide and a highway bridge having a single clear opening 44 feet wide. There is a railroad station at the bridges (**Narrows Station**) from which considerable sea food is shipped. Gasoline is obtainable here. The signal for both bridges is three blasts of a whistle or horn, to be answered by three blasts from the bridges if they can be opened immediately, or one blast if they can not be opened immediately. The draws will be opened at all times between one hour before sunrise and one hour after sunset unless a train is approaching or passing. There is a depth of 6 feet from Eastern Bay to the northern end of the narrows, but there are shoals at its outlet into Chester River. The channel is narrow in places and is usually marked at its northern end by bush stakes.

To enter **Kent Island Narrows** from Eastern Bay, pass $\frac{1}{2}$ mile eastward and northeastward of Parsons Island, sparsely wooded and marked by a house and barn, and steer for the buildings at the narrows on a 353° true (N. mag.) course until abreast of **Hog Island** (marshy and bare of trees). From Hog Island steer eastward to the mouth of **Marshy Creek** and then northward, 100 yards off the point on the north side, and favor the eastern side to the bridges. From the bridges favor the eastern side of the narrows to the northern end, then steer about E. by N. (mag.), passing 100 yards northward of **Long Point**, marked by a clump of pine trees $\frac{1}{4}$ mile from the end.

Tilghmans Creek, on the eastern side of Tilghmans Point, has a depth of 10 feet in the entrance and 11 to 13 feet inside and is ex-

tensively used as a harbor for small local vessels. The entrance is very narrow and is marked by buoys.

Greenwood Creek, on the eastern side of Eastern Bay, $2\frac{3}{4}$ miles east-northeastward of Tilghmans Point, has a depth of 6 feet for 2 miles above the mouth. The best water leads along the eastern shore in approaching the entrance.

Miles River, the most important tributary of Eastern Bay, has a depth of 18 feet to abreast the town of St. Michaels 6 miles above Tilghmans Point, 9 feet to a drawbridge $5\frac{1}{2}$ miles above St. Michaels, and 6 feet for a farther distance of 2 miles. The river has considerable trade carried in small boats, freight steamers, and schooners, the deepest draft being 13 feet. The channel is well marked by lights and buoys as far as the bridge, and strangers should have little trouble in following the channel to the bridge, above which some local knowledge is necessary.

Wye River is on the north side of Miles River, $2\frac{1}{2}$ miles southeastward of Tilghmans Point. The river has several branches, which are frequented by small local boats and grain and produce schooners up to 9 feet draft. There are several farm landings on the creek. The main entrance is eastward of **Herring Island** (a small spot of marsh and sand nearly submerged at high water) and has ample depth and width. There is also a depth of 9 feet across the shoal $\frac{3}{8}$ mile northward of Herring Island. The entrance is marked by buoys. There are no marks above, but strangers should have no trouble by keeping in mid-channel and giving the points a good berth.

The river forks 2 miles above Herring Island. The north branch (Wye River) has a depth of 13 feet for 3 miles above the fork to the western end of Wye Narrows and 8 feet for a further distance of 3 miles. The eastern branch (**Wye East River**) has a depth of 12 feet for 5 miles above the fork to the eastern end of Wye Narrows. **Wye Narrows**, connecting Wye East River with Wye River, has a least depth of 7 feet. It is crossed by an unused bridge having an opening 40 feet wide, which is left open, and a highway drawbridge with a single opening 47 feet wide and a headroom of 5 feet at high water.

Woodland Creek, just eastward of the mouth of Wye River, can be entered only by small boats at high water and is not used.

St. Michaels, a town with railroad communication on the southwest side of Miles River, 14 miles above the entrance to Eastern Bay, is the center of a large oystering and fishing industry. Gasoline and provisions are obtainable, and there is a railway capable of hauling out vessels of 80 tons, 7 feet draft aft and 4 feet forward. The long wharf on the north side of the entrance to the harbor has a depth of 6 feet at the end and is marked by red and gray oyster-houses and a brick stack. The short wharf on the north side of the inner harbor, known as the steamboat wharf, has a depth of 7 feet and is marked by white wharf houses. There is a depth of 10 feet in mid-harbor to near the head. To enter, pass eastward and southward of the red buoy $\frac{3}{4}$ mile northeastward of the wharves, and bring the southern end of Fairview Point (thickly wooded) astern on a 240° true (SW. by W. $\frac{7}{8}$ W. mag.) course, heading for the red houses on the wharf. Pass 60 yards southeastward of the ends of the wharves in entering the inner harbor.

Leeds Creek, on the northeast side of Miles River, 1 mile eastward of St. Michaels, has a depth of 8 feet in mid-channel to the small village of **Tunis Mills**, $2\frac{1}{2}$ miles above the entrance. Schooners of 6 to 8 feet draft go to Tunis Mills. The channel at the entrance is marked by buoys, and above the entrance the mid-channel is clear.

Hunting Creek, on the north side of Miles River, 3 miles above St. Michaels, has a depth of 8 feet for $1\frac{1}{2}$ miles above the entrance but is little used. There are no marks, but the mid-channel is clear.

The **highway drawbridge** crossing Miles River, $5\frac{1}{2}$ miles above St. Michaels has a lift opening 40 feet wide, with a headroom of 6 feet at high water underneath the span when closed.

Tides.—The mean rise and fall of tides is 1.2 feet at Poplar Island and 1.3 feet at St. Michaels.

DIRECTIONS, EASTERN BAY AND MILES RIVER.

From southward.—From Poplar Island Shoal gas and bell buoy, steer for Bloody Point Bar lighthouse on a 21° true (NNE. $\frac{1}{2}$ E. mag.) course for $2\frac{1}{8}$ miles, until the northern end of Poplar Island bears 100° true (ESE. $\frac{1}{2}$ E. mag.), then steer 54° true (NE. by E. $\frac{3}{8}$ E. mag.) for $7\frac{3}{4}$ miles, passing $\frac{1}{4}$ mile southward of the gas buoy southeastward of Kent Point, $\frac{1}{4}$ mile northward of the red buoy off the entrance to Claiborne, and 100 yards southward of the black buoy $1\frac{1}{2}$ miles westward of Tilghmans Point. Then steer 49° true (NE. by E. mag.) to Tilghmans Point Shoal gas buoy and round it at a distance of $\frac{1}{4}$ mile.

From northward.—Round Bloody Point Bar lighthouse at a distance of $\frac{1}{2}$ mile and steer 108° true (SE. by E. $\frac{3}{4}$ E. mag.) to a position $\frac{1}{4}$ mile southward of the gas buoy southeastward of Kent Point, then steer 54° true (NE. by E. $\frac{3}{8}$ E. mag.) and follow the directions in the preceding paragraph.

Tilghmans Point to St. Michaels.—From a position $\frac{1}{4}$ mile northeastward of Tilghmans Point Shoal gas buoy, steer southeastward for $\frac{7}{8}$ mile to a black buoy; pass close westward of it and steer 169° true (S. $\frac{3}{8}$ E. mag.) for 2 miles, heading for Herring Island Shoal light and passing eastward of a horizontally striped buoy and 100 yards eastward of a red buoy. Pass 250 yards westward of the light and steer southeastward for $\frac{1}{2}$ mile to a red buoy. Leave it 100 yards on the starboard hand and steer 149° true (SSE. $\frac{1}{8}$ E. mag.) for $1\frac{1}{8}$ miles to a red buoy northward of Deep Water Point. Leave this 100 yards on the starboard hand and follow the buoyed channel to the entrance of St. Michaels Harbor, passing 200 yards westward of Fairview Point light and 100 yards eastward of a red buoy. Good anchorage can be had in the channel off St. Michaels, southward or southwestward of the red buoy. To enter the harbor, see the description of St. Michaels preceding.

CHESTER RIVER,

on the east side of Chesapeake Bay 21 miles below Baltimore, is navigable for a distance of 40 miles above the entrance and is the approach to the railroad terminus at Love Point and the towns of Queenstown, Centerville, Chestertown, and Crumpton, and many landings. It is frequented by steamers from Baltimore and

schooners carrying grain and produce, besides many smaller boats, the deepest draft being 13 feet.

The main entrance to Chester River is from northward and leads between the northern end of Kent Island and East Neck Island. **Love Point lighthouse** (white house on piles) is the principal guide to the entrance. The entrance has a depth of 24 feet in a narrow channel, and the width of the channel with a depth of 18 feet is 1 mile. The river can also be entered by small boats through Kent Island Narrows.

The main channel of Chester River has a depth of 18 feet for 22 miles above Love Point lighthouse to within 4 miles of Chestertown, 11 feet to Chestertown, and 7 feet for a farther distance of 8 miles to Crumpton. The river above Crumpton has been improved by dredging a channel 6 feet deep and 60 feet wide for a distance of 5 miles to within $\frac{3}{4}$ mile of the town of Millington; in 1922 the channel had a controlling depth of $5\frac{1}{2}$ feet. There is a depth of 1 foot at low water and $3\frac{1}{2}$ feet at high water to Millington.

Steamers from Baltimore make regular trips to all landings on the river as far as Crumpton and connect with the trains at Love Point. There is railroad communication at Love Point, Kent Island Narrows, Queenstown, Centerville, Chestertown, and Millington.

Love Point, at the north end of Kent Island, is a summer resort and the terminus of a railroad to **Lewes** and **Rehoboth**, Del. (service temporarily discontinued east of Greenwood). There are two long wharves; the southern wharf is the landing for steamers from Baltimore making connection with the trains.

Stevensville is a town on the railroad 3 miles southward of Love Point, and **Chester** is a village and railroad station $1\frac{1}{2}$ miles eastward of Stevensville.

Macum and **Piney Creeks**, on the northeast side of Kent Island, are shoal and used only as anchorages for small local craft.

Kent Island Narrows is described on page 213.

Jackson Creek, on the south side of Chester River, $1\frac{1}{4}$ miles eastward of Kent Island Narrows, has a depth of 4 feet to the wharf at the south end and is used as an anchorage by oyster boats. The channel is marked by buoys.

Winchester Creek, $1\frac{1}{4}$ miles eastward of Long Point, has a very narrow entrance nearly bare at low water and a depth 5 to 8 feet inside. It is used as an anchorage by local craft. **Winchester** is a village and railroad station $\frac{1}{4}$ mile from the head of the creek.

East Neck Island, on the east side of Chester River at the entrance, is sparsely wooded, the only prominent mark being a clump of trees on the end of **Hail Point** at the southeast end. **East Neck Island Narrows**, at the northern end, has a depth of about 1 foot, is crossed by a fixed bridge, and is little used.

Queenstown Harbor, on the southeast side of Chester River, $7\frac{1}{2}$ miles above Love Point lighthouse, has been improved by dredging a channel with a present depth of 10 feet and 200 feet wide across the bar at the entrance and has a depth of 8 to 11 feet off the wharves and 7 feet for $\frac{3}{4}$ mile above. The dredged channel is marked by buoys and lights, the outer light forming a range with a light on the northern wharf for the outer end of the dredged channel. There are three wharves at **Queenstown**, the northern one marked by a grain elevator and the southern by red freight houses. Steamers from

Baltimore make regular trips to Queenstown. There is an automobile ferry between Queenstown and North Point.

To enter **Queenstown Harbor**, pass between the buoys at the entrance and steer 128° true (SE. mag.), with the outer light in range with a light on the south gable of a low wharf house about 125 feet to the right of the grain elevator. Follow this course to the outer light, leave the two lights 100 feet on the port hand, then head for the wharves.

Tilghman Creek, on the eastern side of Chester River, 1 mile northward of Queenstown Harbor, has a depth of $1\frac{1}{2}$ feet across the bar close along the western end of the island in the mouth and 6 to 8 feet inside. It is seldom entered.

Reed Creek and **Grove Creek** have a common entrance on the eastern side of Chester River, 12 miles above Love Point lighthouse. There is a depth of 10 feet in the entrance, 8 feet in Reed Creek for 1 mile above the fork, and 6 feet in Grove Creek for $\frac{1}{2}$ mile above a very narrow entrance. Schooners of 6 to 8 feet draft enter the creeks, but the channels are not marked and local knowledge is necessary. A house and barn on the east side at the entrance are prominent.

Corsica River, on the east side of Miles River, 13 miles above Love Point lighthouse, has a depth of $7\frac{1}{2}$ feet to **Centerville Landing**, 5 miles above the entrance and $\frac{3}{4}$ mile from the town of Centerville. The river for a distance of 1 mile below Centerville Landing has been improved by dredging a channel with a present depth of 7 feet and 100 feet wide. The shoalest place is off **Town Bar Point**, just inside the entrance, where the channel is narrow and has a depth of $7\frac{1}{2}$ feet. There are buoys to mark the principal shoals, and the river is easy of navigation as far as the beginning of the dredged channel, above which there are no marks and navigation is difficult without local knowledge.

To enter, pass westward and $\frac{1}{4}$ mile northeastward of the red buoy on the south side at the entrance, and steer 106° true (ESE. mag.) to the red buoy off **Town Bar Point**. Pass close northward of the buoy and follow a general mid-channel course, giving the points a good berth, to the beginning of the dredged channel just above **Fort Point**. From here the best water leads 200 feet off the end of **Sycamore Point** and the same distance off the ends of the two points on the south side above **Sycamore Point**, then southward along the wharves.

Centerville, $\frac{3}{4}$ mile from Centerville Landing, has railroad communication. Gasoline can be obtained at the wharves and provisions from the town.

Church Creek, on the west side of Chester River, at the eastern end of **East Neck Island Narrows**, has a depth of 4 feet in the entrance and 6 feet inside to near the head, but is little used.

Greys Inn Creek, on the west side of Chester River, 12 miles above Love Point lighthouse, has a depth of 8 feet to a small settlement on the western side $2\frac{1}{2}$ miles above the entrance. It is frequented by schooners up to 8 feet draft. There are shoals on both sides at the entrance and a middle ground 1 mile above. These can be avoided by passing close eastward of the black buoy off the entrance and heading for the end of the wharf at **Spring Point**, on the south side, on a 315° true (NW. $\frac{5}{8}$ N. mag.) course until $\frac{1}{4}$ mile from it, and then shaping the course to pass 50 yards off the wharf. There

are no marks above the entrance, but the mid-channel is clear above Spring Point.

Langford Creek, on the northwest side of Chester River, 12 miles above Love Point lighthouse, has a depth of about 12 feet across the bar at the entrance and deeper water to the fork $2\frac{1}{2}$ miles above. **East Fork** has a depth of 10 feet for 3 miles and 6 feet for a farther distance of $1\frac{1}{2}$ miles, and **West Fork** a depth of 10 feet for $2\frac{3}{4}$ miles and 6 feet for a farther distance of $\frac{3}{4}$ mile into either of the two branches at the head. There are no villages on Langford Creek or its tributaries, but there are several farm landings, from which produce and grain are shipped in motor boats and schooners. The principal shoals in the creek as far as the fork are marked by buoys, and strangers of 6 feet or less draft should have no trouble in following the channel with the aid of the chart. There are no marks above the fork. An unmarked shoal extends from **Cacaway Island**, at the fork, southwestward to mid-channel, and above this the mid-channel is clear in both branches if the points be given a good berth.

Cliffs Point, on the northwest side of Chester River, $1\frac{1}{2}$ miles northeastward of the entrance to Corsica River, is marked by a symmetrical clump of trees on the end and a wharf on the east side, at which steamers from Baltimore land. There is a depth of 8 feet at the wharf, and the best water in approaching it is from southward, passing a little eastward of the black buoy off the point. Steamers also make landings at **Upper Spaniard Point Wharf**, opposite Cliffs Point, and at numerous other wharves between that point and Chestertown.

Southeast Creek, on the east side of Chester River, 21 miles above Love Point lighthouse, has a depth of 4 feet in the entrance and 3 feet for 2 miles above to within 300 yards of a landing at the fork, 2 miles from the village of **Church Hill**. It is used by motor boats and a few small vessels of 3 to 5 feet draft. The best water in entering is along the north side. **Island Creek**, on the south side $\frac{1}{2}$ mile above the entrance, has a depth of $3\frac{1}{2}$ feet in the entrance and 6 feet inside to a bridge 2 miles above.

Chestertown is a town on the west side of Chester River, 26 miles above Love Point lighthouse. It is visited by regular steamers and schooners up to 10 feet draft. A drawbridge having a center-pier draw, the east opening 52 feet wide and the west opening 38 feet wide, crosses the river here.

Morgan Creek, on the northwest side of Chester River, 2 miles above Chestertown, has a narrow, crooked channel with a depth of 6 feet for $2\frac{3}{4}$ miles above the mouth. The channel at the mouth is a narrow slough leading between flats nearly bare at low water and is usually marked by bush stakes. Above the entrance the mid-channel is clear. The creek is crossed by a drawbridge $\frac{3}{4}$ mile above the mouth. It is entered by schooners of 5 to 7 feet draft.

Crumpton, on the south side of Chester River, 34 miles above Love Point lighthouse, is visited by regular steamers and schooners, the deepest draft being 8 feet. A drawbridge having a center-pier draw, either opening 35 feet wide with a headroom of 4 feet at high water, crosses the river here.

Millington, a village and railroad station at the head of navigation on Chester River, 40 miles above the mouth, can be reached only

by small motor boats and has little business by water. Boats of 5 feet draft can go to within $\frac{3}{4}$ mile of the town at low water.

Supplies.—Gasoline and provisions can be obtained at Queenstown, Centerville, Chestertown, and Crumpton. There is water on the wharf at Chestertown, and coal in limited quantities can be obtained there.

Towboats are used only during the fruit season.

Pilots.—There are no regular pilots for Chester River or tributaries but many of the local boatmen are competent pilots.

Ice.—The river is usually closed to navigation for extended periods during ordinary winters. During mild winters the channel is kept clear by the regular steamers during most of the time.

Tides.—The mean rise and fall of tides is 1.1 feet at the entrance, 1.3 feet at Queenstown, 1.9 feet at Chestertown, and 2.4 feet at Crumpton. The water is fresh above Chestertown and can be used in boilers.

DIRECTIONS, CHESTER RIVER.

The channel is marked by buoys as far as Crumpton. From the mouth to the entrance of Corsica River, 13 miles above, the channel has ample width and is easily followed. From Corsica River to Chestertown the channel is narrow in places, and there are unmarked shoals close to it. Strangers of a greater draft than 8 feet are advised to take a pilot if going above Corsica River. Between Chestertown and Crumpton the channel is very narrow in places, with broad flats on either side nearly bare at low water. It is marked by buoys, but is difficult without local knowledge; the channel is more easily followed at low water. There are no marks above Crumpton, and local knowledge is required.

The following directions are for vessels of 15 feet draft to Queenstown Harbor and 10 feet draft to the entrance of Corsica River:

From southward.—Pass $\frac{3}{4}$ mile eastward of Sandy Point lighthouse and bring it astern on a 45° true (NE. $\frac{5}{8}$ E. mag.) course, until Love Point lighthouse bears 111° true (SE. by E. $\frac{1}{2}$ E. mag.), then steer 85° true (E. $\frac{1}{8}$ S. mag.) to a position $\frac{3}{8}$ mile northward of Love Point Shoal buoy and pass $\frac{1}{4}$ mile eastward of it. On this course both ebb and flood currents have a southerly set.

Vessels of 10 feet or less draft can pass anywhere between Love Point Shoal buoy and the lighthouse, being careful to give the lighthouse a berth of $\frac{1}{4}$ mile when southeastward of it; and vessels of 5 feet or less draft can cross the shoal anywhere from 200 yards to $\frac{1}{2}$ mile southwestward of the lighthouse. The entire shoal is an area of possible fish traps and strangers are advised to pass northward of Love Point Shoal buoy.

From northward.—Pass $\frac{3}{8}$ mile westward of the red gas buoy $1\frac{3}{4}$ miles westward of Swan Point, and steer 147° true (SSE. $\frac{3}{8}$ E. mag.) for $4\frac{3}{8}$ miles, with Love Point lighthouse well on the starboard bow, to a position $\frac{1}{4}$ mile eastward of Love Point Shoal buoy.

From entrance to Queenstown.—From a position $\frac{1}{4}$ mile eastward of Love Point Shoal buoy, steer 187° true (S. by W. $\frac{1}{4}$ W. mag.) to a position $\frac{1}{4}$ mile westward of buoy No. 1, then steer 145° true (SSE. $\frac{1}{2}$ E. mag.) for 2 miles to a position 300 yards northeastward of

buoy No. 4. From buoy No. 4 steer 121° true (SE. $\frac{5}{8}$ E. mag.) for 2 miles, passing well southward of a black buoy and 400 yards southward of buoy No. 5. From here a 64° true (ENE. $\frac{1}{4}$ E. mag.) course will lead to the buoys at the entrance to Queenstown Harbor.

Queenstown to Corsica River entrance.—From a position $\frac{3}{8}$ mile westward of the red buoy at the entrance to Queenstown Harbor steer 340° true (N. by W. $\frac{1}{8}$ W. mag.) for $2\frac{3}{4}$ miles, passing $\frac{1}{4}$ mile eastward of the black buoy off Hail Point, and to a position 200 yards westward of the red buoy westward of Piney Point. Then steer 30° true (NE. $\frac{3}{4}$ N. mag.) for $2\frac{1}{4}$ miles to a position 150 yards south-eastward of a horizontally striped buoy, and then steer 45° true (NE. $\frac{5}{8}$ E. mag.) for the end of Cliffs Point, until up with the red buoy on the south side of the entrance to Corsica River.

SWAN CREEK AND ROCK HALL HARBOR.

Swan Creek is on the eastern side of Chesapeake Bay, 5 miles northeastward of Love Point lighthouse. The approach, which is also the approach to Rock Hall Harbor, is from southward, eastward of Swan Point Bar. It has a depth of 10 feet to **Deep Landing** (*Gratitude post office*) on the east side of the entrance to the creek and 6 feet for $1\frac{1}{4}$ miles above in a narrow unmarked channel. The channel is marked by buoys as far as Deep Landing, to which point steamers from Baltimore of $6\frac{1}{2}$ to 8 feet draft make regular trips. A ferry from North Point lands at a wharf just southward of Deep Landing. A channel 10 feet deep has been dredged across Swan Point Bar about $\frac{3}{8}$ mile southward of Swan Point. The channel is subject to rapid shoaling, and strangers are advised to use the main entrance around the south end of Swan Point Bar.

Rock Hall Harbor, on the eastern side of the approach to Swan Creek, has been improved by dredging a channel 12 feet deep and 150 feet wide to **Rock Hall Wharf** at the head of the harbor, but no further work is being done and the channel has shoaled to a depth of about 8 feet and is not marked. The harbor is used by many motor boats and small vessels of 3 to 6 feet draft. **Rock Hall** is a village $\frac{1}{2}$ mile eastward of the wharf.

Huntingfield Creek, just southward of Rock Hall Harbor, has depths of 1 to 3 feet and is used only as an anchorage for small craft.

Tavern Creek, just eastward of Swan Point, has a depth of $2\frac{1}{2}$ feet on the bar at the entrance and 6 feet inside for $\frac{1}{2}$ mile. The best water in entering leads along the western side of Little Neck Island.

To enter **Swan Creek** from southward, pass westward and northward of the red buoy $\frac{5}{8}$ mile northeastward of Love Point lighthouse and bring the lighthouse astern on a 33° true (NE. $\frac{1}{2}$ N. mag.) course to the black buoy at the southeast end of Swan Point Bar. Or from northward, pass westward of the red gas buoy $1\frac{3}{4}$ miles westward of Swan Point and the black bell buoy $2\frac{1}{2}$ miles northward of Love Point lighthouse, and steer south-southeastward until Love Point lighthouse bears 213° true (SW. $\frac{1}{2}$ S. mag.), then bring it astern on a 33° true (NE. $\frac{1}{2}$ N. mag.) course, which will lead to the black buoy on the southeast end of Swan Point Bar.

Passing eastward of this buoy a 349° true (N. $\frac{3}{8}$ W. mag.) course, with Swan Creek lighted range ahead, will lead to a position west-

ward of the red buoy on the south side of the entrance to Rock Hall Harbor. This range is not easily picked up by day. To enter Rock Hall Harbor, pass 300 yards northward of the red buoy and steer 55° true (NE. $\frac{1}{2}$ E. mag.) in the dredged channel, heading for the white houses on the wharf. Or to go to Deep Landing, from a position westward of the red buoy continue the 349° true course for 1 mile, passing eastward of a black buoy and westward of a red buoy; then head north-northeastward for the end of the wharf.

CHESAPEAKE BAY ABOVE PATAPSCO RIVER.

Chesapeake Bay extends for 30 miles above the entrance of Patapsco River to the mouth of Northeast and Susquehanna Rivers. It is frequented by passenger and freight steamers and tugboats and barges from Baltimore to landings on the tributaries, besides many vessels bound through the Chesapeake & Delaware Canal, the approach to which is through Elk River and Back Creek. The usual draft of boats frequenting this part of the bay is 5 to 8 feet and the deepest draft 12 feet. All of the tributaries in the upper end of the bay are usually closed to navigation by ice for extended periods during the winter. There are no regular pilots, but local boatmen can usually be obtained at the entrances of the tributaries who are competent to act as pilots. Towboats can be obtained from Baltimore.

There are extensive shoal areas in the northern end of the bay, many of them having fish weirs on them in season. Many of the shoals northward of Pooles Island are rocky and should be avoided even by small craft. A broad channel, with a least depth of 18 feet and well marked by buoys, leads along the eastern side of the bay from Chester River entrance to the mouth of Elk River. The northern end of this channel above Pooles Island is used by all vessels bound to the tributaries at the upper end; the part southward of Pooles Island is used mostly by vessels through the Chesapeake & Delaware Canal, bound to and from points southward of Baltimore. But most of the business in the upper end of the bay is to and from Baltimore, and the generally used route leads from the eastern end of Brewerton Channel, east-northeastward to the gas buoy southward of Pooles Island, northeastward in the channel along the eastern side of Pooles Island until on the Pooles Island range, then eastward across the middle ground on the range into the main channel. The least depth by this route is 12 feet, but it leads close to 10 and 11 foot spots. Directions from Chesapeake City to Baltimore and southward are given under "Inside Route, New York to Norfolk." on page 238.

Fish weirs are prohibited at a greater distance from shore than 800 yards northward of Gunpowder River on the western side and Sassafras River on the eastern side. Between Gunpowder River and the channel leading to Baltimore on the western side, and between Sassafras River and Tolchester Beach on the eastern side, they are prohibited in water exceeding 20 feet in depth.

Tolchester Beach is a pleasure park on the eastern side of Chesapeake Bay, 5 miles north-northeastward of Swan Point and $7\frac{1}{4}$ miles, 77° true (E. $\frac{1}{2}$ N. mag.), from Craighill Channel range front light. It is connected with Baltimore by steamer in summer. With local knowledge a draft of 10 feet can be taken across the shoals from

the eastern end of Brewerton Channel northward of Craighill Channel range front light to the wharf, but strangers should not follow this route with a greater draft than 6 feet. It leads across an area of possible fish traps.

Fairlee Creek, on the eastern side of Chesapeake Bay, $2\frac{3}{4}$ miles east-southeastward of Pooles Island, has a depth of about 4 feet across the bar at the entrance and for $1\frac{3}{4}$ miles above. It is frequented only by produce boats of 3 to 5 feet draft. The entrance is very narrow and has very strong tidal currents. There are no marks for entering.

Worton Creek, on the eastern side of Chesapeake Bay, $3\frac{1}{2}$ miles eastward of Pooles Island, has a depth of 9 to 12 feet in the broad bight at the mouth and 7 feet in the creek to **Buck Neck Landing**, $1\frac{1}{2}$ miles above the entrance. The channel is narrow in the upper part of the creek and is unmarked. Steamers from Baltimore of 6 to 7 feet draft make regular trips to **Worton Manor (Gales Wharf)**, on the northeast side, at the entrance. The channel off Worton Manor affords good anchorage in easterly winds for vessels of 10 feet or less draft.

Still Pond, a bight on the eastern side of Chesapeake Bay, 6 miles above Pooles Island, has depths of 8 to 11 feet and is a safe anchorage for small craft in easterly winds. **Stillpond Creek**, emptying into the bight from eastward, has a depth of $1\frac{1}{2}$ feet across the bar at the entrance and 6 feet inside for some distance. **Church Creek**, emptying into the bight from southward, has a depth of 3 feet in the entrance and deeper water inside. Both creeks are used by small produce boats. There is a wharf $1\frac{1}{2}$ miles northeastward of Still Pond, from which considerable grain and produce are shipped.

Sassafras River, on the eastern side of Chesapeake Bay, 10 miles above Pooles Island, is the approach to the towns of Betterton, Fredericktown, and Georgetown and has considerable trade in steamers, schooners, and barges, the deepest draft being 10 feet. It has a depth of 12 feet to Fredericktown, $8\frac{1}{2}$ miles above **Grove Point** on the north side at the mouth, 8 feet for a farther distance of $1\frac{1}{2}$ miles to **Wilson Point Wharf**, and 5 feet to a landing 1 mile above. The channel is broad and straight for a distance of 3 miles above Betterton, above which it is crooked and narrow in places, but the principal shoals are marked by buoys as far as Fredericktown, and strangers of 6 feet or less draft should have no trouble in following the channel with the aid of the chart. Strangers of deeper draft should take a pilot at Betterton. The channel above Fredericktown is narrow in places and unmarked and is difficult without local knowledge. The mean rise and fall of tides is 1.9 feet at Betterton and 2.3 feet at Georgetown.

Betterton is a summer resort on the south side of Sassafras River, $2\frac{1}{4}$ miles eastward of Howell Point. It is connected with Baltimore, Havre de Grace, and Philadelphia by steamer. There are depths of 11 feet at the outer ends of the two steamboat wharves and the approach is clear. The buildings on the shore and wharves are prominent. Gasoline and provisions are obtainable.

Lloyds Creek, on the south side of Sassafras River, 2 miles east-southeastward of Betterton, has depths of 1 to 3 feet inside and is seldom entered. It is separated from Sassafras River by a low sand spit.

Turner Creek, on the south side of Sassafras River, $4\frac{1}{2}$ miles above Betterton, has a depth of 7 feet to a landing at the foot of a road just inside the mouth and 6 feet in a narrow channel for $\frac{1}{2}$ mile above. Some produce is shipped from here in schooners and barges. The entrance is narrow and unmarked.

Back Creek, on the north side of Sassafras River, 6 miles above Betterton, has a depth of $7\frac{1}{2}$ feet in the entrance and 5 feet in a narrow unmarked channel for $1\frac{1}{2}$ miles above. It is little used.

Island Creek, on the south side of Sassafras River, $7\frac{1}{2}$ miles above Betterton, has a depth of 6 feet in a narrow unmarked channel for $\frac{1}{2}$ mile above the entrance. There are no wharves and little business by water.

Fredericktown and **Georgetown** are towns on opposite sides of Sassafras River, $9\frac{1}{2}$ miles above Betterton. They are connected by a highway bridge having a lift draw, with an opening 40 feet wide, with a headroom of 5 feet at high water. The towns are connected with Baltimore by steamer and are visited by tug boats and barges up to 10 feet draft. Boats of 7 feet draft carrying produce and fertilizer go $2\frac{1}{2}$ miles above at high water. Gasoline and provisions are obtainable at both places. There are depths of 7 feet at the wharves at Fredericktown and 12 to 18 feet at Georgetown.

The ruins of an old wharf north of Grove Point are prominent.

Pond Creek and **Pearce Creek**, $3\frac{1}{2}$ and 5 miles, respectively, north-eastward of the entrance to Sassafras River, can be entered only by small boats at high water and are not used.

Elk River, emptying into the head of Chesapeake Bay from north-eastward, 16 miles above Pooles Island, is important as the approach to the western end of the Chesapeake & Delaware Canal. There is also some business at **Elkton**, a town at the head of navigation on Elk River, $14\frac{1}{2}$ miles above the mouth. It has a depth of 16 feet for 7 miles to the mouth of Back Creek and 7 feet for a farther distance of $6\frac{1}{2}$ miles to the intersection of Elk and Little Elk Rivers, 1 mile below Elkton. Above the fork there is a depth in the Elk River of 7 feet at low water through a dredged channel 80 feet wide to the paper mill at Elkton. Little Elk River has a controlling depth of 4 feet to the fixed bridge at the head of navigation.

The channel in Elk River from the mouth to Back Creek is broad and easily followed. Above Back Creek it is crooked and narrow in places. It is marked by buoys for a distance of 5 miles above the mouth of Back Creek, above which it leads between flats, bare at low water and covered by marsh grass in summer. Strangers should have no trouble in taking a draft of 5 feet at low water to the junction of Elk and Little Elk Rivers with the aid of the chart. Above that point local knowledge is necessary. The mean rise and fall of tides is 2.1 feet at the entrance and 2.6 feet at Elkton Landing.

Turkey Point, on the west side, at the entrance to Elk River, is a sparsely wooded bluff with abrupt slopes on the south end. The most prominent mark is Turkey Point lighthouse, a white tower on the highest part of the bluff.

Bohemia River, on the east side of Elk River, 4 miles above the entrance, has a depth of 7 feet for $3\frac{3}{4}$ miles to the junction of Little Bohemia and Great Bohemia Creeks and 6 feet for a distance of $1\frac{1}{2}$ miles in Little Bohemia Creek and $2\frac{1}{2}$ miles in Great Bohemia Creek. A highway drawbridge crosses the river $\frac{1}{2}$ mile below the fork. The

channel is broad and easily followed for a distance of 2 miles above the entrance, above which it is narrow and crooked and difficult without local knowledge. The river and the creeks at the head are frequented by grain and produce boats, the deepest draft being 9 feet and usual draft 3 to 6 feet.

Town Point Wharf is on the eastern side of Elk River, $5\frac{1}{2}$ miles above the entrance. Steamers between Baltimore and Philadelphia make regular stops. There is a depth of 10 feet at the end.

Back Creek is the approach to the western end of the Chesapeake & Delaware Canal at Chesapeake City, and is described on page 233. Directions for Back Creek and Elk River are given on page 238.

Elkton, at the head of navigation on Elk River, is on the main line of the Pennsylvania Railroad. It has several industrial plants and some trade in schooners and barges up to 8 feet draft. Gasoline, provisions, water, and coal in limited quantities are obtainable. A fixed bridge having a clear headroom of 9 feet at high water crosses the river at Elkton. Motor boats lay just above and below the bridge in a depth of 3 to 5 feet, and there is no navigation above.

Northeast River empties into the northern end of Chesapeake Bay 5 miles north-northeastward of Turkey Point. The approach to the river leads westward of Turkey Point and between the western side of **Elk Neck** (high and thickly wooded) and the extensive flats westward. There is a depth of 12 feet to the mouth of the river and 7 feet anywhere in mid-channel for a distance of $3\frac{1}{2}$ miles above the mouth, above which there are mud flats nearly bare at low water, through which a channel has been dredged to the town of Northeast. The dredged channel has shoaled to a depth of $2\frac{1}{2}$ feet at the lower end and is marked by posts at the entrance, upon which lights are sometimes maintained by local people. Above the posts the channel is well defined by the marsh on each side. The mean rise and fall of tides is 2.5 feet.

Charleston is a village and railroad station on the western side of Northeast River, $2\frac{1}{2}$ miles above the entrance. Gasoline may be obtained.

Northeast, a town with railroad communication at the head of navigation on Northeast River, $4\frac{1}{2}$ miles above the entrance, is frequented only by small local craft, the deepest draft being 5 feet, which can be taken to the town only at a good high water. Gasoline and provisions are obtainable, and there is a railway capable of hauling out boats of 40 feet length and 4 feet draft.

To enter **Northeast River**, pass $\frac{1}{4}$ to $\frac{1}{2}$ mile westward of Turkey Point and follow the high wooded shore northeastward to the entrance, passing $\frac{1}{4}$ mile westward of the points. The river is clear anywhere in mid-channel from the entrance to the beginning of the dredged channel. Pass close to the posts marking the entrance to the dredged channel, then follow the main stream in mid-channel to the wharves at Northeast.

A channel leads from the entrance of Northeast River westward, close along the north shore, to the mouth of Susquehanna River at Havre de Grace. It has ample depth except at the eastern end, where the depth is 3 feet, and the western end, where the depth is 5 feet. The shoalest part of the flats is covered with marsh grass, which serves to mark the channels. The position and depth of the channel is subject to considerable change by the freshets and ice

gorges from the Susquehanna River. The best water in entering from Northeast River leads 200 yards southeastward and southward and 100 yards southwestward of Carpenter Point, then follows the north shore closely until $\frac{3}{4}$ mile westward of the point on the west side of Principio Creek, then leads westward for the wharves at Havre de Grace.

Susquehanna River, emptying into the head of Chesapeake Bay from northwestward, is the approach to the towns of Havre de Grace and Port Deposit. The approach to the river is a narrow channel leading between broad flats nearly bare at low water and has been improved by dredging to a depth of 15 feet and width of 200 feet as far as Havre de Grace; in June, 1922, it had a least depth of 14 feet. There is a depth of 11 feet from Havre de Grace to the head of navigation at Port Deposit. The channel as far as Havre de Grace is marked by Fishing Battery and Havre de Grace lighthouses and by buoys. There are no marks above, but the channel is easy of navigation.

Ice gorges and freshets are of frequent occurrence in Susquehanna River during the breaking up of the ice in the spring, the water at Port Deposit sometimes rising to a height of 15 to 18 feet above the normal high water and causing considerable damage. The position and depth of the channels are subject to considerable change through these causes. The river is usually entirely closed to navigation for a period of about three months in winter. The mean rise and fall of tides is 2.1 feet.

Fishing Battery lighthouse, 350 yards eastward of the dredged channel near the lower end, is a light on a skeleton tower near a white dwelling, with another building and a few trees near it and a large area of marsh grass around it. A shallow dredged basin leads in toward the light from the west side.

Havre de Grace, on the western side, at the entrance to Susquehanna River, is on the main line of the Pennsylvania and Baltimore & Ohio Railroads and is connected with Betterton and Baltimore by steamer. There are depths of 6 to 10 feet at the wharves. Gasoline, provisions, water, and coal in limited quantities are obtainable.

A rock with a depth of $5\frac{1}{2}$ feet over it, and marked by a red and black horizontal striped buoy at its southern end, lies $\frac{1}{8}$ mile off the wharves at Havre de Grace and about $\frac{1}{4}$ mile below the lower bridge. The generally used channel for vessels bound through the bridges leads about 100 yards eastward of the buoy. There are said to be several rocks between this rock and the wharves westward, which require local knowledge to avoid.

Three bridges cross Susquehanna River in the vicinity of Havre de Grace. The lower one, a highway bridge $\frac{3}{4}$ mile northward of Havre de Grace lighthouse, has a center pier draw across the channel on the western side of Garrett Island, each opening 100 feet wide, with a headroom of 26 feet at high water when closed. The bridge is fixed on the eastern side of Garrett Island and has a headroom of 26 feet at high water.

The **Pennsylvania Railroad bridge**, 150 feet above the highway bridge, has a center pier draw across the channel on the western side of Garrett Island, each opening 100 feet wide with a headroom of 52.4 feet at high water when closed. The bridge is fixed on the eastern side of Garrett Island and has a headroom of 52.4 feet at high

water. The east opening in both draws is generally used by vessels bound north and the west opening by vessels bound south. A towboat is stationed at Havre de Grace by the railroad company to assist sailing vessels through the bridges.

The **Baltimore & Ohio Railroad bridge**, $\frac{3}{4}$ mile above the Pennsylvania Railroad bridge, is fixed on both sides of Garrett Island and has a headroom of 87 feet at high water. The main channel leads through the second opening from the western side of Garrett Island.

Perryville is a town on the eastern side of Susquehanna River, opposite Havre de Grace. A draft of about 10 feet at low water can be carried from the main channel off Havre de Grace, across the middle ground anywhere from 200 yards to $\frac{1}{2}$ mile southward of the lower bridge, into the channel leading to Perryville, and this is the course usually followed by all vessels bound to Perryville that can pass under the lower bridges. Twin stacks of a brick power house near the southern point of the town are prominent, as well as the buildings of the U. S. Public Health Service Hospital, which they are part of. A short dredged channel leads to a Government landing $\frac{1}{4}$ mile below the highway bridge, and there is a private wharf just south of the same bridge.

Garrett Island, just above Havre de Grace, is high and wooded, with no prominent marks.

Port Deposit is a town on the northeast side of Susquehanna River, $3\frac{1}{2}$ miles above Havre de Grace. It has railroad communication and is connected with Baltimore by steamer. There is a depth of 11 feet to abreast the town and 6 to 9 feet at the wharves. Gasoline and provisions are obtainable. The deepest draft of vessels going there are tugboats and barges up to 12 feet draft carrying stone from the quarries in this vicinity. Small boats can go a short distance above Port Deposit, but the channel is obstructed by rocks and should not be attempted by a stranger.

Directions, Susquehanna River.—These directions are good for a draft of 10 feet to Havre de Grace:

Passing 200 yards northeastward of the black and white perpendicularly striped buoy $1\frac{1}{4}$ miles westward of Turkey Point lighthouse, steer 320° true (NNW. $\frac{7}{8}$ W. mag.), heading for Fishing Battery lighthouse, for $2\frac{1}{2}$ miles until about 200 yards eastward of the black gas buoy off Locust Point. Pass 50 yards northward of the buoy and steer 267° true (W. $\frac{3}{8}$ N. mag.) for $\frac{1}{2}$ mile, with the red buoy on the eastern side of the entrance to the dredged channel well on the starboard bow until southward of it, then haul north-northwestward, passing 50 yards westward of the buoy, and follow the dredged channel northward for 3 miles, passing 350 yards westward of Fishing Battery lighthouse and leaving the buoys at a distance of about 60 yards. There is marsh grass on the shoalest part of the flats on both sides. From the first buoy above Fishing Battery lighthouse to the upper end of the buoyed channel Havre de Grace lighthouse will be a little on the port bow. Pass 300 yards eastward of the lighthouse and, if bound to Havre de Grace, keep 100 yards off the ends of the wharves.

If bound to **Port Deposit**, from abreast Havre de Grace lighthouse steer northward to the red and black horizontally striped buoy marking a $5\frac{1}{2}$ -foot rock $\frac{1}{8}$ mile off the wharves, pass 100 yards eastward of the buoy and then head for the draw in the lower bridge.

From the second bridge follow the western shore of Garrett Island at a distance of about 225 yards to the upper bridge, pass through the middle of the second opening from the western side of Garrett Island, and steer 0° true (N. $\frac{1}{2}$ E. mag.), with a stone quarry on the eastern bank a little on the port bow, until $\frac{1}{4}$ mile from the bank, then steer northwestward, hauling gradually in to a distance of $\frac{1}{8}$ mile from shore and following it at this distance to the wharves at Port Deposit.

Swan Creek, on the western side of Chesapeake Bay, $3\frac{1}{2}$ miles below Havre de Grace, has a depth of about 5 feet in a narrow, unmarked channel to near the head, and is little used.

Spesutie Narrows, between Spesutie Island and the mainland westward, has a least depth of $2\frac{1}{2}$ feet and is considerably used by small local craft. The best water leads eastward of an islet near the northern end, and southward of it the mid-channel is clear.

Romney Creek, on the western side of Chesapeake Bay, 6 miles northeastward of Pooles Island, has a depth of 6 feet in a narrow unmarked channel for 3 miles above the mouth and 2 feet for a farther distance of $1\frac{1}{2}$ miles. It is used only by small boats. A clump of trees on **Taylor's Island** and a house and barn on the western side of **Little Romney Creek** are the only prominent marks. There is an unmarked rocky patch, with a least depth of $\frac{1}{2}$ foot $\frac{3}{4}$ mile south-southeastward of the entrance, and the best water in approaching the entrance leads westward of it. A 7° true (N. by E. $\frac{1}{4}$ E. mag.) course from Worton Point Shoal gas buoy will lead clear of all dangers to the entrance.

Seneca Creek, $2\frac{1}{2}$ miles northward of Millers Island, has a depth of 8 feet in the entrance and 5 feet in mid-channel to near the head. It is frequented only by small craft.

Middle River, $2\frac{1}{4}$ miles 297° true (NW. by W. mag.) from the black buoy east-northeastward of Millers Island, has a depth of 8 feet for 3 miles above the entrance and $2\frac{1}{2}$ feet for a farther distance of $\frac{1}{2}$ mile to the head of navigation. Unmarked shoals extend off both points at the entrance and from many of the points above the entrance, but the mid-channel is clear if the points be given a good berth. Middleriver is a village and summer resort at the head of navigation; it is on the railroad and is the terminus of an electric road to Baltimore. The river has many tributaries, the most important being **Frog Mortar Creek**, which has a depth of 6 feet to near the head.

Hawk Cove, northwestward of Millers and Hart Islands, is the main approach to Back River and affords secure anchorage in depths of 8 to 10 feet. A shoal extends half way across the entrance from the northwest side.

Millers Island is a bare marsh without prominent marks. A shoal extending northeastward is marked off its end by a black buoy.

Hart Island is marshy and marked by a thick clump of trees in the center and scattered trees near the northeast end.

The thoroughfare between the southwest end of Hart Island and the mainland has a depth of $1\frac{1}{2}$ feet at low water and $2\frac{1}{2}$ to 3 feet at high water and is considerably used. **Craighill Channel** range rear light (skeleton tower) is on the east side.

Back River has a depth of 6 feet for a distance of $5\frac{1}{2}$ miles above the entrance and 5 feet for a farther distance of 1 mile to an electric

railway bridge. The bridge has a draw opening 25 feet wide, and small boats can go about 1 mile above in either branch at high water, but boats seldom go above the bridge. The shoals at the entrance are marked by buoys, and above the entrance the mid-channel is clear for vessels of 4 feet draft to the bridge. The best water leads westward of an unmarked middle ground 3 miles above the entrance. A row of piles extends $\frac{3}{8}$ mile eastward from the mouth of Bread and Cheese Creek, $\frac{3}{4}$ mile below the bridge. The main approach to the river is through Hawk Cove, but small craft from southward usually enter through the thoroughfare westward of Hart Island.

Bush River, on the western side of Chesapeake Bay, 3 miles north-northeastward of Pooles Island, has a depth of 6 feet to a railroad drawbridge 7 miles above the entrance and is frequented only by small produce and pleasure boats. The principal shoals inside the entrance are marked by buoys, and above these the mid-channel is clear and easy of navigation to the bridge. The bridge has a draw opening 35 feet wide and a headroom of 12 feet at high water. The river is shoal and little used above. Bush River is a railroad station at the bridge. The mean rise and fall of tides is 1.5 feet.

Pooles Island, on the western side of Chesapeake Bay, 10 miles above the mouth of Patapsco River, is low and covered with trees. There is a wharf on the east side at which steamers from Baltimore make landings in summer. The white piles of the wharf and a white building near it are prominent from southward. **Pooles Island range** (white posts with slatted day marks), on the southeast end of Pooles Island, is a guide for crossing the middle ground eastward of the island and is used by all vessels bound northward from Baltimore.

The channel westward of Pooles Island is marked by buoys and has a least depth of $7\frac{1}{2}$ feet, although there is an unmarked 6-foot spot 600 yards northwestward of Pooles Island lighthouse. It is used only by small craft from the tributaries on the western side or boats seeking shelter from westerly winds.

Gunpowder River, **Middle River**, and **Back River** have a common entrance westward of Pooles Island, leading between Sprys Island on the north and Millers Island on the south. They are frequented mostly by small produce and pleasure boats and an occasional small tugboat, the deepest draft being 7 feet and usual draft 2 to 4 feet. The mean rise and fall of tides is 1.2 feet.

Gunpowder River has a depth of 11 feet for 2 miles above **Sprys Island** in the mouth, 6 feet to within 1 mile of a railroad bridge $6\frac{1}{2}$ miles above Sprys Island, and 4 feet to the bridge. The bridge has a draw opening, but the river is shoal and there is no navigation above. **Sprys Island** is a bare marsh marked by two shanties. The main entrance leads southward and westward of the island, is unmarked, and is narrow as far as Carrolls Point, 1 mile above, with shoals of 3 to 6 feet depth close to the channel. Navigation to this point is difficult without local knowledge for anything except small craft. Above this point the mid-channel is clear to the bridge if the points be given a good berth. A 355° true (N. $\frac{1}{4}$ E. mag.) course from the black buoy east-northeastward of Millers Island, heading for the prominent clump of trees on the point 1 mile northwestward of Sprys Island, will lead to the entrance. A draft of 2 feet at low water can be carried into the river from northward, close around the

end of **Ricketts Point**. **Harewood Park** is a railroad station at the western end of the bridge across Gunpowder River. **Magnolia** is a post village and railroad station 1 mile eastward of the bridge.

INSIDE ROUTE, NEW YORK TO NORFOLK.

From New York Upper Bay the generally used passage is through Kill van Kull and Arthur Kill, and thence around Great Beds lighthouse to the entrance of Raritan River; but strangers frequently take the more open passage through New York Lower Bay and Raritan Bay to Raritan River. Thence the passage leads up Raritan River to New Brunswick, and thence through the Delaware & Raritan Canal to Bordentown. Thence down Delaware River to Delaware City, and thence through the Chesapeake & Delaware Canal to Chesapeake City. Thence down Back Creek and Elk River to the head of Chesapeake Bay at Turkey Point, and thence down Chesapeake Bay and through Hampton Roads and Elizabeth River to Norfolk.

A draft of 7 feet can be taken through the passage from New York Bay to Delaware Bay, and 9 feet from Delaware Bay to Chesapeake Bay, and these are the limiting drafts. The greatest speed permitted in the canals is $4\frac{1}{2}$ statute miles per hour. A vessel with a speed of 10 miles, running in daytime only, can make the passage in three and one-half to four days under favorable conditions. It is advisable to inquire beforehand whether the Delaware & Raritan Canal is open for navigation.

Supplies.—Coal in limited quantities can be obtained at numerous places, but the best and most convenient coaling places are Perth Amboy, Philadelphia, Baltimore, and Norfolk. Gasoline, provisions, and water can be obtained at any of the towns or cities along the route.

Pilots can be obtained on inquiring at Perth Amboy, New Brunswick, Bordentown, Delaware City, Chesapeake City, and Baltimore for either the whole or parts of the passage. A fisherman or pilot may sometimes be obtained at the mouth of Back Creek competent to pilot a vessel to Chesapeake City. The fees are not prescribed by law.

Ice sufficient to interfere with navigation of small craft may be expected at any time between December and April and is most severe during January and February. The canals are kept open as long as navigation is possible and are opened as soon as navigation is possible in the spring. During mild winters local vessels use them throughout most of the winter, but strangers should make inquiries about their condition before attempting the passage.

KILL VAN KULL AND ARTHUR KILL.

These passages have combined length of 17 miles from Robbins Reef lighthouse to Ward Point, the southern end of Staten Island, and a width varying from 600 yards to less than 200 yards. There is considerable shipping, especially through Kill van Kull. Strangers should have no difficulty in making the passage with a draft of 10 feet, with the aid of the chart and the directions. The Baltimore & Ohio Railroad crosses Arthur Kill about $\frac{1}{2}$ mile southward of Elizabethport. There is a clear width of 202 feet on each side of the

center pier of the draw; the eastern channel has the deeper water and is generally used.

Anchorage is not permitted in the channel of Kill van Kull and Arthur Kill, anchorage limits being prescribed by regulation. The anchorage on the western side of Arthur Kill off Perth Amboy is good and convenient; its eastern limit is a line running northward from the horizontally striped buoy to the Lehigh Valley coal docks.

Tides.—The mean rise and fall of the tides at Shooters Island is 4.6 feet; high water occurs 17 minutes later than at Governors Island. At South Amboy the mean rise and fall is 5.3 feet, and high water occurs 8 minutes later than at Sandy Hook.

RARITAN RIVER

has a length of 10½ miles from South Amboy to New Brunswick, a width varying from ½ mile to 125 yards, and is crooked in places. Dredging has been done to obtain a channel 200 feet wide and 10 feet deep to a point ¼ mile above the mouth of South River, and thence 100 feet wide with the same depth to New Brunswick. The controlling depth to New Brunswick in 1923 was 9 feet. At high water the marshy banks are generally covered, making it difficult for a stranger to follow the channel. Two drawbridges cross the river near its entrance at South Amboy.

New Brunswick is an important city at the entrance to the Delaware & Raritan Canal from Raritan River. The canal forms a basin abreast the city, which is the harbor of New Brunswick. At high water of spring tides a draft of 8 feet has been taken into the basin through the entrance lock of the canal, but 7 feet is the deepest draft for which the canal company will be responsible. The size of vessels entering the basin is limited to the size of the canal lock. Coal, water, and provisions can be had in the basin.

Sailing vessels, which are not going to tow down the Raritan River, are advised to remain in the basin at New Brunswick until the wind serves for them to sail down the river. There is no place for some distance below New Brunswick at which a vessel of 7 feet draft can make fast outside of the basin without lying aground at low water, and the river channel is too narrow for vessels to anchor.

Towboats.—A towboat can be obtained at Perth Amboy and South Amboy and sometimes at New Brunswick, and can always be had at New Brunswick by telephoning to Perth Amboy.

Tides.—At New Brunswick high water is 49 minutes later and low water 1 hour 33 minutes later than at Sandy Hook; the mean rise and fall of tides is 6 feet.

DELAWARE & RARITAN CANAL.

This canal is 38 miles long from its eastern entrance at New Brunswick on the Raritan River to its western entrance at Bordentown on the Delaware River. The principal places on the canal and their distances, in miles, from New Brunswick are: **Bound Brook**, 7; **Millstone**, 12; **Kingston**, 21; **Trenton (Coalport Basin)**, 32; **Bordentown**, 38. There are 13 locks in the canal, the dimensions of which are 210 feet long, 23 feet 4 inches wide, and 7 feet deep. The deepest draft permitted through the canal is 7 feet. Masted vessels are limited to

masts less than 50 feet above canal level by the arched stone bridge at New Brunswick, which has a clear height of 50 feet in the middle. Coal in limited quantities may be obtained from local dealers at the principal places on the canal, but steamers will find it more convenient to coal at Perth Amboy and Philadelphia than along the canal. The water in the canal is fresh but is not good for drinking purposes.

Toll rates, which are subject to change, are charged by the canal company and are collected at the entrance where the vessel is given clearance. Towage through the canal can be arranged at either entrance. Vessels are not locked through the canal on Sunday.

The following information is taken from the **Rules and Regulations Governing the Delaware & Raritan Canal**, published by the company, and which will be furnished by them at the canal entrance on application:

When under way at night, a small green signal light shall be carried on the stem; a steamer shall carry in addition a white light at the end of her flagstaff, or if towing other boats two white lights at the end of her flagstaff; no other lights or reflectors shall be carried. No vessel shall carry sail in the canal. The speed shall not exceed $4\frac{1}{2}$ miles (statute) per hour. When a vessel overtakes another, the slower shall give the inner track to the faster, unless within 300 yards of a lock or bridge. When in danger of meeting at a bridge or where both can not pass, the one going westward shall lie to. Everything towed by horses or mules, and rafts, on meeting steamboats, shall keep on the side next the towpath; in all other cases everything meeting shall keep to the right. When approaching a lock or bridge, notice shall be given on arriving within 300 yards of the same by a horn, bell, or whistle. Steamboats passing other boats or vessels, either in motion or at stopping places, shall "slow-up" till entirely past, especially in passing Coalport. Steamboats must not check headway by backing while in the locks nor blow out their boilers while passing locks or bridges. The signal at night that a lock is ready will be two whistles from the lock engine for boats bound west and four for those bound east. No stones, rubbish, dead carcasses, or other offensive matter shall be thrown or dropped into the water.

DELAWARE RIVER, FROM BORDENTOWN TO DELAWARE CITY.

The distance is 60 miles from Bordentown to Delaware City and the channel generally has ample width and is easily followed; but extra caution is required in the first $\frac{1}{2}$ mile from Bordentown, where there is a depth of $7\frac{1}{2}$ feet in a narrow channel. This is the shoalest place in the channel. Channels have been dredged 12 feet deep and 200 feet wide from Philadelphia to Trenton and 30 feet deep and 800 to 1,200 feet wide from Delaware Bay entrance to Philadelphia. Many of the shoals in the river are bare at or before low water and are generally covered with marsh grass, which makes them usually well defined. The water in the river above Chester is fresh and suitable for boilers.

Coal can be obtained at Philadelphia, either at the wharves or by lighters; it can also be obtained at Chester and New Castle and in limited quantities at Delaware City, but the facilities are not so good as at Philadelphia.

Anchorage.—Except for $\frac{1}{2}$ mile below Bordentown, there is a sufficient width at most places in the channel for anchorage, for which the chart must be the guide. The anchorage limits at Philadelphia are prescribed by regulation. Below Marcus Hook suitable anchorage may be selected off the ranges.

Delaware City, at the entrance of the Chesapeake & Delaware Canal from Delaware River, has little commerce except that passing through the canal. Provisions and gasoline may be obtained. The wharves have a depth of 8 to 9 feet in Delaware River at their ends. There is a depth of 9 feet on the northern side at the entrance to the canal lock, and vessels usually lie here when waiting to lock in.

Tides.—The mean rise and fall of tides at Bordentown is 4.7 feet; Burlington, 5.4; Philadelphia, 5.3; Chester, 5.8; and Delaware City, 5.9. High water occurs at Bordentown 2 hours 25 minutes, and at Burlington 1 hour 32 minutes later than at Philadelphia, and at Chester 1 hour 24 minutes, and at Delaware City 2 hours 53 minutes earlier than at Philadelphia.

CHESAPEAKE & DELAWARE CANAL.

This canal is 12 miles long from its eastern entrance at Delaware City, on Delaware Bay, to its western entrance at Chesapeake City, on Back Creek. There are three locks in the canal, the dimensions of which are 220 feet long, 24 feet wide, and 9 feet deep. The deepest draft permitted through the canal is 9.3 feet. All bridges over the canal have draws. The water in the canal is fresh, but is not suitable for drinking purposes. The canal has been purchased by the Government and is maintained and operated free of toll charges. Vessels are required to obtain a pass bill from the entrance lock, which must be shown at each lock and surrendered when locking out of the canal. Strangers passing through this canal are advised to inquire at the entrance whether there are any shoal places which require attention.

The following information is taken from the **Regulations Governing the Chesapeake & Delaware Canal**, and which will be furnished by them at the canal entrance on application:

The pass bill must be shown to each lock keeper before passing through. No vessel shall carry sail in the canal, nor shall the speed exceed $4\frac{1}{2}$ miles (statute) per hour. The latter is important on account of serious washing of the banks when this speed is exceeded. Vessels are timed going through the canal to observe any violations of this rule. Vessels passing shall keep to the right. Masted vessels when meeting unmasted boats shall take the outer track. Rafts shall always keep the outer track. When a vessel overtakes another, the slower shall give the inner track to the faster, unless within 300 yards of a lock or bridge. When approaching a lock or bridge, notice shall be given on arriving within 300 yards of the same by a horn or bell. When passing through at night a light shall be carried on the bow. Vessels lying in the canal at night shall carry a light on the bow and at the stern. No earth, stone, timber, or other material shall be placed or put in the canal.

The Chesapeake and Delaware Canal is under improvement contemplating a sea-level canal to have a controlling depth of 12 feet at mean low water. The project will be completed early in 1926. The new canal for the most part follows the line of the present canal, the greatest deviation from the present route being at the Delaware entrance, which will be at Reedy Point, $2\frac{1}{2}$ miles below Delaware

City. The entrance channel will be a dredged cut, 12 feet deep and 150 feet wide, between two stone jetties. During the period of construction vessels navigating the canal should use all precautions not to interfere with the dredges and other plant at work.

BACK CREEK AND ELK RIVER.

Back Creek has a length of $3\frac{1}{4}$ miles from Chesapeake City to Elk River. It has been improved by dredging a channel 12 feet deep and 150 feet wide from the 12-foot curve at the mouth of the creek to Chesapeake City. It is well marked by lights and buoys. The deepest draft using the creek is 9 feet. A pilot may be obtained on inquiry at Chesapeake City, and sometimes at the entrance to the creek. The channel in the creek is too narrow for anchorage. Gasoline and provisions are obtainable at Chesapeake City, and there is a shipyard and marine railway.

Elk River has a length of nearly 8 miles from Back Creek to the entrance of the river at Turkey Point. The channel is wide and easily followed.

Tides.—In Back Creek high water occurs about 2 hours 20 minutes after high water at Baltimore, and the mean rise and fall of tides is 2.6 feet.

CHESAPEAKE BAY.

The channel in Chesapeake Bay is well marked and easily followed by the class of vessels using the inland waterway. Coal, gasoline, repairs, and supplies of all kinds can be best obtained at Baltimore and Norfolk. Some supplies and gasoline can be had at numerous places on the tributaries of the bay, the best places near the sailing route being Annapolis, Solomons on the Patuxent River, and Cockrells Creek (Reedville) on the Great Wicomico River. There are small marine railways at Annapolis, Solomons, Reedville, and Carter Creek on the Rappahannock River. Anchorage can be had at numerous places on the shores of the bay and its tributaries, depending on the direction of the wind. Those most frequently used and easiest of access are:

Severn River, at Annapolis in the mouth of Spa Creek, depth 13 feet; also in Annapolis Roads southeastward of Greenbury Point Shoal lighthouse.

Patuxent River.—Small vessels usually anchor on the north side, between Drum Point lighthouse and the horizontally striped buoy $\frac{5}{8}$ mile westward of the lighthouse and small craft frequently anchor in the cove on the north side of Solomons Island ($1\frac{5}{8}$ miles westward of Drum Point lighthouse).

Cornfield Harbor, on the west side of Point Lookout, entrance of Potomac River, is occasionally used; it is sheltered only from northerly and northeasterly winds.

Great Wicomico River and the mouth of Cockrell Creek is a good and convenient harbor. The fish stakes off the entrance may give trouble at times to vessels entering. The depths at the anchorage are 15 to 20 feet.

Rappahannock River.—Anchorage, exposed to southeasterly winds, can be selected in the entrance.

Mobjack Bay is exposed to southerly and southeasterly winds, and except toward its head or in the arms it is exposed to northwest winds also.

Hampton Roads.—Small craft usually anchor in what is locally known as Mother Hawkins Hole, on the north side of the eastern part of Hampton Bar; the entrance is between the wharf at Old Point Comfort and the horizontally striped buoy close westward of it. Small craft usually seek shelter in Hampton Creek in bad weather. Small vessels frequently anchor on the northerly part of Craney Island Flats westward of the dredged channel leading to Norfolk.

Tides.—The mean rise and fall of tides at Baltimore is 1.2 feet; Rappahannock River entrance, 1.2; Old Point Comfort, 2.5; and Norfolk, 2.8.

DIRECTIONS, INSIDE ROUTE, NEW YORK TO NORFOLK.

These directions are good in the daytime for a draft of 7 feet to Philadelphia and for a draft of 9 feet from Philadelphia to Chesapeake Bay. Strangers are advised not to run at night. The directions in Chesapeake Bay are intended for vessels of 9 feet or less draft that use the inland route but are good for vessels of greater draft in most places. With westerly winds small vessels can follow with advantage the western shore more closely, being guided by the chart, but care should be taken at night to avoid the fish traps which extend long distances from shore in places, especially on the shoals between Great Wicomico River and Old Point Comfort. (For information concerning fish traps in Chesapeake Bay, see p. 96.)

Through Kill van Kull and Arthur Kill to South Amboy, 19 miles.—Enter Kill van Kull between Robbins Reef lighthouse and the north end of Staten Island, giving the lighthouse a berth of 600 yards and the shore of Staten Island a berth of 300 yards, and follow a mid-channel course for about $2\frac{1}{2}$ miles from Constable Point. Then pass about 100 yards southward of the red buoy eastward of Bergen Point lighthouse, and pass 220 yards south of the lighthouse.

Then steer 267° true (W. $\frac{5}{8}$ N. mag.) and pass about 75 yards southward of the wharves on the southern side of Shooters Island. When the western end of Shooters Island is abeam, steer about 308° true (NW. $\frac{1}{4}$ N. mag.) for $\frac{1}{4}$ mile to a position a little southward of a red buoy, then a more westerly course for $\frac{1}{4}$ mile, leaving a black buoy on the port hand and a horizontally striped buoy on the starboard hand.

Then steer about 269° true (W. $\frac{3}{4}$ N. mag.), leaving a red buoy on the starboard hand, and then follow a mid-channel course past Elizabethport. Vessels of 7 feet draft can pass through either of the wide openings of the railroad drawbridge southward of Elizabethport, although the eastern opening has the deeper water. When $\frac{1}{2}$ mile southward of the bridge, steer 185° true (S. by W. $\frac{1}{4}$ W. mag.) and pass in mid-channel eastward of Buckwheat Island (small and grassy) and westward of Pralls Island, following a general mid-channel course.

From the southern end of Pralls Island follow the western bank at a distance of about 150 yards, except for a distance of $\frac{3}{8}$ mile northward of Tufts Point, where that bank should be given a berth of 200 yards. Pass about 150 yards southward of Tufts Point, steer

about 270° true (W. $\frac{7}{8}$ N. mag.), and pass about 150 yards northward of Smoking Point. Then follow the northwestern bank at a distance of about 300 yards, passing northward and westward of the white anchorage buoys lighted beacons and the red buoy at Storys Flat. When past lighted beacon No. 6, follow the western bank at a distance of 200 yards to Perth Amboy. Anchorage can be had on the western side of the channel at Perth Amboy.

Pass 100 yards eastward of the horizontally striped buoy off Perth Amboy, steer about 153° true (S. by E. $\frac{5}{8}$ E. mag.), and pass 100 yards westward of Ward Point and eastward of the horizontally striped buoy southward of the point. Pass 200 yards eastward and southward of Great Beds lighthouse and steer 268° true (W. $\frac{5}{8}$ N. mag.), heading between a lighted beacon and buoy No. 9. Pass about 100 feet northward of the buoy and steer 304° true (NW. mag.), heading for the left draw in the railroad bridge. Anchorage can be had on the north side of the channel northward of a line joining the anchorage buoys and the center pier of the drawbridge.

New York Lower Bay and Raritan Bay to South Amboy.—Pass eastward and southward of the black bell buoy, lying $\frac{3}{4}$ mile northward of West Bank lighthouse, and steer 239° true (WSW. $\frac{1}{8}$ W. mag.) for $7\frac{1}{2}$ miles, passing $\frac{1}{2}$ mile northward of West Bank and Old Orchard Shoal lighthouses, passing southward of Old Orchard Shoal red buoy and to a position $\frac{1}{4}$ mile northward of Conaskonk Point Shoal buoy No. 3 (occ. white). Then steer 269° true (W. $\frac{3}{4}$ N. mag.) for $3\frac{1}{4}$ miles, passing between buoy No. 7 and a lighted beacon to a position 200 yards southward of Great Beds lighthouse, as in the preceding paragraph.

Raritan River to New Brunswick, $10\frac{1}{2}$ miles.—Except at high water, when the marshy banks are covered in places, vessels of 7 feet or less draft, with the aid of the chart, should have no difficulty in going up the Raritan River to New Brunswick.

From the railroad drawbridge at South Amboy pass about 200 feet off Sandy Point and then go through the draw in the second bridge. Then follow the northern bank, giving the ends of the wharves a berth of 200 to 300 feet, to light No. 2, which is on the lower end of a dike on the northwestern side. Opposite the light are buoys marking a dredged cut leading along the south shore. Do not enter this cut, but follow the northern dike and the northwest bank above it at a distance of 200 feet until above the opening in the dike on the southeast side of the channel $\frac{1}{2}$ mile above light No. 3. Beyond the light is Raritan Arsenal with a dock marked by a light paralleling the bank for 650 yards. Then keep in mid-channel as defined by the dikes until up to light No. 5, then bring it astern and cross over to the north bank; then pass Deep Point, marked by a light, on the north bank, lying opposite the western end of the dike on the southern side, at a distance of 200 feet.

In making the bend around Crab Island follow the dike on the northwest side of the channel at a distance of 300 feet. Then cross over and follow the eastern and southern bank, at a distance of 200 feet, past Sayreville (large brickworks) and the canal leading to Washington. From the canal entrance (light No. 7 close westward) keep in mid-channel northward through Long Reach for a distance

of $\frac{1}{4}$ mile, and then gradually favor the eastern bank and follow it at a distance of 125 feet in the northern part of this reach to avoid a shoal, marked by light No. 8, with little water on it making out from the western bank. When the river begins to bend northwestward, edge out gradually to mid-channel, and so continue around the bend until approaching the entrance of South River (marked by light No. 9 on the western point).

Then favor the southern bank past the entrance of South River and the dock $\frac{1}{4}$ mile westward. When past this dock, edge over gradually and favor the eastern bank northward through Rocky Reach, passing eastward of light No. 10, marking a shoal. At the head of this reach there are large potash works with a canal leading to them. When the river begins to bend northwestward, edge out gradually to mid-channel, and so continue around the bend to Lawrence Creek (on southern bank) and also in the next reach northwestward to Martins Landing.

There is a stone dock on the north bank 400 yards westward of Martins Landing; favor the north bank between them until 300 yards westward of the stone dock, and then keep in mid river around the next bend until up with the rocky bluff on the southern bank. Then favor well the southern bank to the lock at New Brunswick.

Delaware River from Bordertown to Delaware City, 60 miles.—A stranger, proceeding with caution in the narrow parts of the river and using the lead, should have little difficulty in making the passage from Bordertown to Delaware City with the aid of the chart and the directions. Extra caution is required in the first $\frac{1}{2}$ mile below Bordertown.

Bordertown to Florence.—On leaving the lock at Bordertown, head so as to pass about 125 feet westward of the steamboat wharf on the east bank just south of the entrance to the creek, and then head about 214° true (SW. $\frac{1}{8}$ S. mag.), with Bordertown light (white post), on the south bank $\frac{3}{8}$ mile distant, a little on the starboard bow. Leave a black buoy 50 feet on the starboard hand, and then haul westward so as to follow the curve of the channel, and pass about midway between the light and a horizontally striped buoy.

When below Bordertown light steer 229° true (SW. by W. $\frac{1}{8}$ W. mag.), following at first the southeastern bank at a distance of 100 yards, to a mid-channel position 600 yards above Newbold Island. Then haul westward gradually, giving the northern bank a berth of over 150 yards, and pass in mid-channel northward of Newbold Island until past Penn Manor light; this light is on the north bank westward of a small wharf.

Bring this light astern on a 228° true (SW. by W. $\frac{1}{8}$ W. mag.) course, heading for Kinkora light and passing between the buoys which mark the channel at Kinkora Bar; Kinkora light may be seen well to the left of a sand wharf. When abreast the clubhouse wharf, haul a little westward, following the buoys to abreast the sand wharf, pass about 150 yards northward of it, and then follow the southern bank at a distance of 150 yards to Florence (large pipe works).

Florence to Torresdale.—Keep in mid-channel in making the bend northward of Florence and then follow the western bank at a distance of 150 yards, drawing in to 100 yards from that bank from the

northern end of the shipyard above Bristol to abreast the yacht club wharf $\frac{3}{8}$ mile below. Then follow a mid-channel course between Burlington Island and Bristol, and when up with the ferry landing (Bristol) bring it astern on a 206° true (SW. $\frac{7}{8}$ S. mag.) course and pass 75 to 100 yards westward of a red buoy off the lower end of Burlington Island.

Favor, if anything, the southern bank in passing Burlington until abreast of the large foundry at its western end, and then steer 258° true (W. $\frac{1}{4}$ S. mag.) for College Point light (northern bank) until $\frac{1}{4}$ mile from it, and pass it at a distance of 200 yards. Then steer 250° true (W. by S. mag.) for the standpipe in the town of Beverly (southern bank); the black buoy near Beverly should be nearly ahead. Pass about 200 feet southward of this buoy and 300 feet off the northerly wharves of Beverly on a 282° true (WNW. $\frac{1}{4}$ W. mag.) course, with an old wharf on the northern bank a little on the starboard bow.

Pass 150 yards southeastward of this wharf and steer 239° true (WSW. mag.), with the wharf at Torresdale a little on the starboard bow and a concrete tower and high chimney a little on the port bow, to the entrance of the dredged channel leading past Mud Island. Pass through the dredged channel on a 236° true (SW. by W. $\frac{3}{4}$ W. mag.) course, with a lighted range astern, being guided by the buoys and heading for the high chimney, and continue this course to a position 275 yards southeastward of the wharf at Torresdale (marked by Torresdale light.)

Torresdale to Philadelphia.—Follow the west bank at a distance of 200 yards to the southern end of Torresdale, then steer 222° true (SW. $\frac{1}{2}$ W. mag.), with the prominent clubhouse and flagstaff on the end of the pier at Riverton a little on the port bow; Riverton light is also on the end of the pier. On this course pass about 100 yards southeastward of the black spar buoy, which lies near the northwestern bank 1 mile below Torresdale, and about 200 yards northward of the red spar buoy, which lies near mid-river 1 mile below Torresdale.

Pass 200 yards north of Riverton light (end of pier) and bring the light astern on a 262° true (W. $\frac{1}{8}$ N. mag.) course; on this course pass 150 yards north of the red spar buoy 1 mile westward of Riverton. Then follow the western bank at a distance of about 300 yards and pass 150 yards westward of red buoy No. 2 off Bridesburg. Then steer 202° true (SSW. $\frac{3}{4}$ W. mag.) for the draw (draw is 50 feet above high water), and when through the bridge follow a mid-river course in passing Philadelphia. Anchorage can be made on the eastern side of the river, either at Petty Island, 2 miles below the bridge, or from Kaighn Point to Gloucester, 5 to 7 miles below the bridge.

Philadelphia to Chester.—Keep in mid-river in passing Philadelphia, and when up with the ferry landing at Gloucester steer 206° true (SW. by S. mag.) about 1 mile on the Horseshoe east group upper range (ahead). Pass about 200 yards eastward of gas buoy No. 37 and steer 240° true (WSW. $\frac{1}{8}$ W. mag.) on the Eagle Point range (ahead).

Pass about 200 yards northward of buoy No. 46 and steer 274° true (WNW $\frac{7}{8}$ W. mag.) about $1\frac{7}{8}$ miles on the Horseshoe range, and

when up with gas and bell buoy No. 44 haul southward and pass about 200 yards westward of it. Then steer 234° true (SW. by W. $\frac{1}{2}$ W. mag.) on the Fort Mifflin Bar range (may be seen over the ferry landing ahead); this course follows the northern bank at a distance of about 300 yards, passes about 300 yards westward of Block Island light (with white day mark) near mid-river, and leads north of a red buoy and south of a black buoy.

Then steer 250° true (W. by S. mag.) for $1\frac{1}{4}$ miles, giving the southern bank a berth of about 300 yards, until up on the Tinicum Island range. Then steer 272° true (W. $\frac{7}{8}$ N. mag.), keeping the Tinicum Island range astern, and pass about midway between the buoys off the western end of Tinicum Island. When gas buoy No. 2T is on the port beam distant 300 yards, steer 230° true (SW. by W. $\frac{1}{8}$ W. mag.), with Chester range astern to the red gas buoy off the south end of Chester.

Chester to Delaware City.—From the red gas buoy steer 237° true (SW. by W. $\frac{3}{4}$ W. mag.) on the Marcus Hook range for $4\frac{1}{2}$ miles, passing between the buoys which mark the edges of the channel. When Grubbs Landing (crib in water to starboard) is nearly abeam and a little beyond gas buoy 2M, steer 215° true (SW. $\frac{1}{8}$ S. mag.) nearly 3 miles on the Bellevue range, which is ahead.

When abreast of Edgemoor Rolling Mill and buoy No. 2B is on the port beam, steer 197° true (SSW. $\frac{1}{4}$ W. mag.) for $4\frac{3}{4}$ miles, with the Cherry Island range astern, until at the intersection with the Deepwater Point range and abreast gas buoy No. 2C. Then steer 234° true (SW. by W. $\frac{1}{2}$ W. mag.) for 4 miles, passing about 300 yards eastward of black buoy No. 29 and the same distance westward of the horizontally striped buoy at the northeastern end of Bulkhead Shoal; red nun buoy No. 6 should be on the port bow, and as it is approached should be left 200 yards on the port hand.

When abreast of red nun buoy No. 6, steer about 217° true (SW. mag.) for $\frac{3}{4}$ mile until almost up to can buoy No. 5. Then haul southward, pass 100 yards eastward of buoy No. 5 and steer 190° true (S. by W. $\frac{5}{8}$ W. mag.) for 1 mile to a position about 100 yards westward of gas buoy No. 4. Then steer 163° true (S. $\frac{3}{4}$ E. mag.) for 1 mile to a position 100 yards eastward of buoy No. 1. Then steer 140° true (SSE. $\frac{7}{8}$ E. mag.) to a position about 300 yards off the wharves at Delaware City. Anchorage may be made on the eastern side of the channel, about $\frac{1}{4}$ mile off the wharves, in 15 to 17 feet. If going into the canal, whistle when $\frac{1}{4}$ to $\frac{1}{2}$ mile away and slow down. The entrance lock is on the south side of the southernmost wharf, and vessels make fast to the wharf, on the starboard side at the entrance to the lock, until the lock is open and ready to enter. The current in the river setting past the ends of the wharves must be considered and allowed for when turning in for the canal wharf. (See description of the canal on p. 232.)

Through Back Creek and Elk River to Turkey Point, 11 miles.—The channel through Back Creek has been dredged to 12 feet and 150 feet wide, and is well marked by buoys and lights. Vessels must slow down when passing other vessels.

From the lock at Chesapeake City favor the northern bank until up to buoy No. 11, passing 100 feet off the ruins of an old wharf on the southern bank. When past the buoy head for a bushy tree on

the ridge east of Long Point, passing the point on the south side about 40 yards off and 25 yards southward of buoy No. 9. Leave the end of the shipyard wharf west of Long Creek 50 feet on the starboard hand and nun buoy No. 10 just below, about 25 yards on the port hand. After rounding the latter buoy steer 237° true (SW. by W. $\frac{5}{8}$ W. mag.), heading for a white dead tree on the shore ahead to abeam of nun buoy No. 8, then steer 274° (W. by N. mag.) heading between a lighted beacon (spar buoy temporarily on station) and spar buoy No. 6, leaving can buoy No. 5, off Emilys Point, 25 yards to northward. When abeam of the lighted beacon steer 261° true (W. $\frac{1}{8}$ S. mag.), heading between a spar buoy and Groves Bar light (nun buoy temporarily on station). When abeam of the light steer 274° true (W. by N. mag.) and round Randall Wharf Light at a distance of 50 yards. Then steer 212° true (SW. $\frac{1}{2}$ S. mag.) until between can buoy No. 1 and spar buoy No. 4. Then steer 238° true (SW. by W. $\frac{3}{4}$ W. mag.) to leave nun buoy No. 2 about 30 yards to southward. Then make good a 230° true (SW. by W. $\frac{1}{8}$ W. mag.) course, leaving Back Creek Light (buoy temporarily on station) 50 yards to southward, and Courthouse Point, which is the prominently projecting point on the south bank $\frac{3}{4}$ mile from the entrance to Back Creek, 300 yards to southward.

Continue the 230° true (SW. by W. $\frac{1}{8}$ W. mag.) course nearly $\frac{1}{2}$ mile past Courthouse Point, and when Old Field Point light (pile structure in water off prominent point of north bank) bears 286° true (NW. by W. $\frac{7}{8}$ W. mag.), distant nearly $\frac{1}{4}$ mile, steer 256° true (W. $\frac{5}{8}$ S. mag.), so as to pass about 225 yards southward of it. Continue the course for $\frac{7}{8}$ mile past the light to a position 350 yards northward of Old Town Point Wharf light and then haul southward to a mid-channel position westward of it. Then steer 225° true (SW. $\frac{5}{8}$ W. mag.) for 5 miles, keeping in the middle of the river to the entrance at Turkey Point.

Turkey Point to Baltimore, 35 miles.—From the middle of the entrance of Elk River abreast Turkey Point, steer 235° true (SW. by W. $\frac{1}{2}$ W. mag.) for 11 miles, passing $\frac{1}{2}$ mile southeastward of a lighted beacon $1\frac{1}{2}$ miles northward of Howell Point, a little over $\frac{1}{4}$ mile southeastward of the black buoy lying near the middle of the bay off Still Pond, and to a position $\frac{1}{4}$ mile northwestward of Worton Point Shoal gas buoy.

Then steer 209° true (SW. $\frac{3}{4}$ S. mag.) for $3\frac{1}{4}$ miles to a position $\frac{1}{4}$ mile east-southeastward of bell buoy No. 3. Then steer 261° true (W. $\frac{1}{8}$ S. mag.) on the Pooles Island lighted range (front, flashing white, rear, fixed white, and slatted day marks) ahead, passing $\frac{1}{8}$ mile southward of the bell buoy and to a position 100 yards northwestward of buoy No. 4. Then steer 229° true (SW. by W. mag.) for $1\frac{1}{2}$ miles to a position 150 yards southeastward of Pooles Island Flats gas buoy. Then steer 238° true (SW. by W. $\frac{7}{8}$ W. mag.) for 9 miles to gas and bell buoy No. 3B, Brewerton Channel. This course leads $\frac{3}{8}$ mile northwestward of a red buoy and $\frac{3}{4}$ mile northwestward of Craighill Channel range front light.

Then follow the dredged channels to Baltimore, course 291° true (NW. by W. $\frac{1}{2}$ W. mag.) on the Brewerton Channel range, following the buoys to gas and bell buoy No. 12B; then steer a little more northward to gas and bell buoy No. 4M; and then steer 320° true

(NW. by N. mag.), following the buoys which mark the Fort McHenry Channel to Lazaretto Point. Then steer more northward into Baltimore Harbor between Lazaretto Point lighthouse and Fort McHenry, passing eastward of the two black buoys on the northeast side of Fort McHenry. The anchorages in Baltimore Harbor are marked by white buoys; they are on the northeasterly side of the harbor between Canton and Fells Point and in the cove on the southerly side eastward of Federal Hill.

Baltimore to Sandy Point, 20 miles.—Follow the dredged channels as described in the preceding paragraph in a reversed direction to gas and bell buoy No. 3B, Brewerton Channel, and then steer south-eastward to gas and bell buoy No. 13K. Then steer 149° true (SSE. $\frac{1}{8}$ E. mag.) on the Cutoff Channel range astern, and follow the buoys to gas and bell buoy No. 5K nearly 1 mile southward of Seven Foot Knoll lighthouse. Then steer 161° true (S. by E. $\frac{1}{8}$ E. mag.) for $1\frac{1}{2}$ miles to gas and bell buoy No. 9C. Then steer 180° true (S. $\frac{5}{8}$ W. mag.) on the Craighill Channel range astern, and follow the buoys to a position 350 yards eastward of Baltimore lighthouse. Then steer 154° true (S. by E. $\frac{3}{4}$ E. mag.) for $2\frac{3}{4}$ miles to a position $\frac{3}{4}$ mile eastward of Sandy Point lighthouse.

Turkey Point to Sandy Point direct, 32 miles.—From the middle of the entrance of Elk River abreast Turkey Point steer 235° true (SW. by W. $\frac{1}{2}$ W. mag.) for 11 miles, passing $\frac{1}{2}$ mile southeastward of a lighted beacon $1\frac{1}{2}$ miles northward of Howell Point, a little over $\frac{1}{4}$ mile southeastward of the black buoy lying near the middle of the bay off Still Pond, and to a position $\frac{1}{4}$ mile northwestward of Worton Point Shoal gas buoy.

Then steer 202° true (SSW. $\frac{5}{8}$ W. mag.) for $7\frac{1}{2}$ miles, passing nearly $\frac{3}{8}$ mile westward of a red buoy, nearly $\frac{1}{4}$ mile eastward of buoy No. 3, and to a position 300 yards eastward of the black buoy lying westward of the summer resort of Tolchester Beach. Then steer 218° true (SW. mag.) for $3\frac{1}{2}$ miles until Craighill Channel range front lighthouse bears 286° true (WNW. mag.). Then steer 198° true (SSW. $\frac{1}{4}$ W. mag.) for $9\frac{1}{2}$ miles, passing over $\frac{1}{4}$ mile westward of the red gas buoy off Swan Point, and to a position $\frac{3}{4}$ mile eastward of Sandy Point lighthouse.

Sandy Point to Norfolk, 138 miles.—From a position $\frac{3}{4}$ mile eastward of Sandy Point lighthouse steer 197° true (SSW. $\frac{1}{8}$ W. mag.) for $7\frac{1}{4}$ miles to a position 1 mile eastward of Thomas Point Shoal lighthouse. Then steer 186° true (S. by W. $\frac{1}{8}$ W. mag.) for 9 miles, passing $1\frac{1}{2}$ miles westward of Bloody Point Bar lighthouse, and to Poplar Island Shoal gas and bell buoy. Then steer 177° true (S. $\frac{3}{8}$ W. mag.) for 12 miles, passing $2\frac{1}{2}$ miles westward of Sharps Island lighthouse, and to Sharps Island gas and bell buoy.

From Sharps Island gas and bell buoy make good a 163° true (S. by E. mag.) course for 42 miles, passing 1 mile eastward of Cove Point lighthouse, $1\frac{7}{8}$ miles eastward of Cedar Point lighthouse, $2\frac{1}{2}$ miles westward of Hooper Island lighthouse, $1\frac{1}{2}$ miles eastward of Point No Point lighthouse, and to a position 1 mile eastward of Smith Point lighthouse.

Then make good a 180° true (S. $\frac{1}{2}$ W. mag.) course for $29\frac{1}{2}$ miles, passing close to Tangier Island Shoal Lump gas and bell buoy, $3\frac{1}{4}$ miles eastward of Windmill Point lighthouse, and $1\frac{1}{4}$ miles east-

ward of the gas buoy at the end of Rappahannock Spit, and to a position 1 mile eastward of Wolf Trap lighthouse.

Then make good a 186° true (S. by W. mag.) course for 23 miles, passing 1 mile eastward of New Point Comfort Middle Ground buoy, 3 miles eastward of York Spit and Back River lighthouses, and in a depth of about 15 feet across the Horseshoe about 1 mile eastward of Thimble Shoal lighthouse.

On approaching Thimble Shoal lighthouse haul westward and pass 300 yards southward of it. Then steer 251° true (WSW. $\frac{3}{4}$ W. mag.), pass about $\frac{1}{4}$ mile northward of Willoughby Spit gas and bell buoy, and pass about midway between Old Point Comfort and Fort Wool. Then steer 225° true (SW. $\frac{1}{2}$ W. mag.) and pass 200 yards eastward of Sewall Point Shoal gas and bell buoy. Then stand southward in the dredged channel to Norfolk, being guided by the buoys, some lighted, which mark the edges of the channel. The courses are 200° true (SSW. $\frac{1}{4}$ W. mag.) to the entrance to the dredged channel, 184° true (S. $\frac{7}{8}$ W. mag.) to abreast Bush Bluff gas and bell buoy, then 172° true (S. $\frac{1}{4}$ E. mag.) until abreast the southerly piers at Lambert Point, and then 131° true (SE. $\frac{1}{8}$ S. mag.) to the city wharves.

The anchorage for small vessels near Norfolk are on the northeast side of the channel opposite Hospital Point, on the west side of the channel between Hospital Point and Portsmouth, and on the south side of the Eastern Branch between Norfolk and Berkley.

APPENDIX.

NAVIGATIONAL AIDS AND THE USE OF CHARTS.

The Coast and Geodetic Survey is charged with the survey of the coasts, harbors, and tidal estuaries of the United States and its insular possessions and issues the following publications relating to these waters as guides to navigation: Charts, Coast Pilots, Tide Tables, Current Tables, a catalogue of these publications, and Notice to Mariners, the last-named published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey.

CHARTS bear three dates, which should be understood by persons using them: (1) The date (month and year) of the edition, *printed* on the late charts below the border in a central position; (2) the date of the latest correction to the chart plates, *printed* in the lower left-hand corner below the border; (3) the *date of issue, stamped* below the border and just to the left of the subtitle. Charts show all necessary corrections as to lights, beacons, buoys, and dangers, which have been received to the *date of issue*, being hand corrected since the latest date printed in the lower left-hand corner. All small but important corrections occurring subsequent to the *date of issue* of the chart are published in Notice to Mariners and should be applied by hand to the chart immediately after the receipt of the notices. The date of the edition of the chart remains unchanged until an extensive correction is made on the plate from which the chart is printed. The date is then changed and the issue is known as a new edition. When a correction, not of sufficient importance to require a new edition, is made to a chart plate, the year, month, and day are noted in the lower left-hand corner. All the notes on a chart should be read carefully, as in some cases they relate to the aids to navigation or to dangers that can not be clearly charted. The charts are various in character, according to the objects which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately 1:200,000, which exhibit the approaches to a large extent of coast, give the offshore soundings, and enable the navigator to identify his position as he approaches from the open sea.
2. General charts of the coast, on scales of 1:100,000 and 1:50,000, intended especially for coastwise navigation.
3. Coast charts, on a scale of 1:50,000, by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors.
4. Harbor charts, on larger scales, intended to meet the needs of local navigation.

NOTE.—General charts of the Philippine Islands are on scales 1:200,000, 1:100,000, and 1:50,000; coast charts are on scales 1:100,000 and 1:50,000.

COAST PILOTS, relating to surveyed waters of the United States, Porto Rico, Alaska, Hawaiian Islands, and the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. From time to time, as the material accumulates, supplements are issued, containing the more important corrections since the publication of the volume. The supplements are printed on one side of the paper only, so that they may be cut and pasted in the appropriate places in the volume. Supplements and other corrections for any volume can be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

TIDE TABLES.—The Coast and Geodetic Survey Tide Tables are issued annually in advance of the year for which they are made and contain the predicted time and height of the tides for each day in the year at the principal ports of the world, including the United States and its possessions. A table of tidal differences is given by means of which the tides at more than 3,000 intermediate ports may be obtained. Separate reprints from the general Tide Tables are

issued for the Atlantic and Pacific coasts of the United States and its dependencies.

CURRENT TABLES, which have heretofore been issued as a part of the Tide Tables, are now published separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States.

AGENCIES for the sale of the Charts, Coast Pilots, Tide Tables, and Current Tables of the Coast and Geodetic Survey are established in many ports of the United States and in some foreign ports. They can also be purchased in the office of the Coast and Geodetic Survey, Washington, D. C., or any of the field stations. If ordered by mail, prepayment is obligatory. Remittances should be made by postal money order or express order, payable to the "Coast and Geodetic Survey." Postage stamps, checks, and drafts can not be accepted. The sending of money in an unregistered letter is unsafe. Only catalogue numbers of charts need be mentioned. The catalogue of charts and other publications of the survey can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey, Washington, D. C.

OTHER PUBLICATIONS.—Lists of Lights, Buoys, and other Daymarks of the United States, its insular possessions, and the Great Lakes, are published by the Bureau of Lighthouses and may be purchased from its sale agencies or from the Superintendent of Documents, Washington, D. C. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey; this publication can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

USE OF CHARTS.

ACCURACY OF CHARTS.—The value of a chart depends upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become. In these respects the source from which the information has been compiled is a good guide. This applies particularly to the charts of the Alaska Peninsula, Aleutian Islands, Arctic Ocean, and part of Bering Sea and the Philippine Islands. The early Russian and Spanish surveys were not made with great accuracy, and until they are replaced by later surveys these charts must be used with caution.

With respect to these regions the fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail. A wide berth should therefore be given to every rocky shore or patch, and this rule should invariably be followed, viz, that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

With respect to a well-surveyed coast only a fractional part of the soundings obtained are shown on the chart, a sufficient number being selected to clearly indicate the contour of the bottom. When the bottom is uneven, the soundings will be found grouped closely together, and when the slopes are gradual fewer soundings are given. Each sounding represents an actual measure of depth and location at the time the survey was made. Shores and shoals where sand and mud prevail, and especially bar harbors and the entrances of bays and rivers exposed to strong tidal currents and a heavy sea, are subject to continual change of a greater or less extent, and important ones may have taken place since the date of the last survey. In localities which are noted for frequent and radical changes, such as the entrance to a number of estuaries on the Atlantic, Gulf, and Pacific coasts, notes are printed on the charts calling attention to the fact.

It should also be remembered that in coral regions and where rocks abound it is always possible that a survey with lead and line, however detailed, may have failed to find every small obstruction. For these reasons when navigating such waters the customary sailing lines and channels should be followed, and those areas avoided where the irregular and sudden changes in depth indicate conditions which are associated with pinnacle rocks or coral heads.

DREDGED CHANNELS.—These are generally shown on the chart by two broken lines to represent the side limits of the improvement. Before completion of the project the depth given is that shown by the latest survey received from the engineer in charge. After completion the depth given is the one proposed to be maintained by redredging when necessary. The actual depth of a completed channel may be greater than the charted depth shortly after dredging and less when shoaling occurs as a result of storms or other causes. These changes are

of too frequent occurrence and uncertain duration to chart. Therefore, when a vessel's draft approximates the charted depth of a dredged channel, the latest information should be obtained before entering.

DANGER CURVES.—The curves of depth will be found useful in giving greater prominence to outlying dangers. It is a good plan to trace out with a colored pencil the curve next greater than the draft of the vessel using the chart and regard this as a "danger curve," which is not to be crossed without precaution. Isolated soundings shoaler than surrounding depths should be avoided, as there is always the possibility that the shoalest spot may not have been found.

CAUTION IN USING SMALL-SCALE CHARTS.—It is obvious that dangers to navigation can not be shown with the same amount of detail on small-scale charts as on those of larger scale; therefore in approaching the land or dangerous banks regard should be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile. For the same reason bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

DISTORTION OF PRINTED CHARTS.—The paper on which charts are printed has to be dampened. On drying distortion takes place from the inequalities in the paper, which varies with the paper and the amount of the original dampening; but it is not sufficient to affect ordinary navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree when carefully plotted upon the chart, especially if the lines to objects be long. The longer the chart the greater the amount of this distortion.

BUOYS.—Too much reliance should not be placed on buoys always maintaining their exact position, especially when in exposed positions. It is safer, when possible, to navigate by bearings or angles to fixed objects on shore and by the use of soundings.

GAS BUOYS and other unwatched lights can not be implicitly relied on; the light may be altogether extinguished or, if intermittent, the apparatus may get out of order.

LIGHTS.—The distances given in the light lists and on the charts for the visibility of lights are computed for a height of 15 feet for the observer's eye. The table of distances of visibility due to height, published in the Light List, affords a means of ascertaining the effect of a greater or less height of the eye. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking for a light, the fact may be forgotten that from aloft the range of vision is increased. By noting a star immediately over the light a bearing may be afterwards obtained from the standard compass. The actual power of a light should be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen. The power of a light can be estimated by its candlepower as given in the light lists and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

FOG SIGNALS.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the wind, large areas of silence have been found in different directions and at different distances from the origin of the sound signal, even in clear weather. Therefore too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal may require some time before it is in readiness to act. A fog often creeps imperceptibly toward the land and is not observed by those at a lighthouse until it is upon them, whereas a vessel may have been in it for many hours while approaching the land. In such a case no signal may be sounded. When sound travels against the wind, it may be thrown upward; in such a case a man aloft might hear it when it is inaudible on deck. The conditions for hearing a signal will vary at the same station within short intervals of time. Mariners must not, therefore, judge their distance from a fog signal by the force of the sound and must not assume that a signal is not sounding because they do not hear it. Taken together, these facts should induce the utmost caution when nearing the

land or danger in fog. The lead is generally the only safe guide and should be faithfully used.

SUBMARINE BELLS have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus can determine the approximate bearing of the signal. These signals can be heard also on vessels not equipped with receiving apparatus by observers below the water line, but a bearing of the signal can not then be readily determined.

TIDES.—A knowledge of the tide, or vertical rise and fall of the water, is of great and direct importance whenever the depth at low water approximates to or is less than the draft of the vessel and, wherever docks are constructed so as to be entered and left near the time of high water. But under all conditions such knowledge may be of indirect use, as it often enables the mariner to estimate in advance whether at a given time and place the current will be running flood or ebb. In using the tables slack water should not be confounded with high or low tide nor a flood or ebb current with flood or ebb tide. In some localities the rise or fall may be at a stand while the current is at its maximum velocity.

THE TIDE TABLES published by the Coast and Geodetic Survey give the predicted times and heights of high and low waters for most of the principal ports of the world and tidal differences and constants for obtaining the tides at all important ports.

PLANE OF REFERENCE FOR SOUNDINGS ON CHARTS.—For the Atlantic coast of the United States and Porto Rico the plane of reference for soundings is the mean of all low waters; for the Pacific coast of the United States and Alaska, with the two exceptions noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Puget Sound, Wash., the plane of reference is 2 feet below mean lower low water and for Wrangell Strait, Alaska, it is 3 feet below mean lower low water. For the Atlantic coast of the Canal Zone, Panama, the plane of reference for soundings is mean low water, and for the Pacific coast of the same it is low-water springs. For foreign charts many different planes of reference are in use, but that most frequently adopted is low-water springs.

It should be remembered that whatever plane of reference is used for a chart there may be times when the tide falls below it. When the plane is mean low water or mean lower low water, there will generally be as many low waters or lower low waters below those planes as above them; also the wind may at times cause the water to fall below the plane of reference.

TIDAL CURRENTS.—In navigating coasts where the tidal range is considerable special caution is necessary. It should be remembered that there are indrafts into all bays and bights, although the general set of the current is parallel to the shore. The turn of the tidal current offshore is seldom coincident with the time of high and low water on the shore.

At the entrance to most harbors without important tributaries or branches the current turns at or soon after the times of high and low water within. The diurnal inequality in the velocity of current will be proportionately but half as great as in the height of the tides. Hence, though the heights of the tide may be such as to cause the surface of the water to vary but little in level for 10 or 12 hours, the ebb and flow will be much more regular in occurrence. A swift current often occurs in narrow openings between two bodies of water, because the water at a given instant may be at different levels. Along most shores not seriously affected by bays, tidal rivers, etc., the current usually turns soon after high and low waters.

Where there is a large basin with a narrow entrance, the strength of the current in the entrance may occur near the time of high and low water, and slack water at about half tide, outside. The swiftest current in straight portions of tidal rivers is usually in the mid-channel, but in curved portions the strongest current is toward the outer edge of the curve. Counter currents and eddies may occur near the shore of straits, especially in bights and near points.

TIDE RIPS AND SWIRLS occur in places where strong currents occur, caused by a change in the direction of the current, and especially over shoals or in places where the bottom is uneven. Such places should be avoided if exposed also to a heavy sea, especially with the wind opposing the current. When these conditions are at their worst, the water is broken into heavy, choppy seas from all directions, which board the vessel, and also make it difficult to keep control, owing to the baring of the propeller and rudder.

CURRENT ARROWS on charts show only the usual or mean direction of a tidal stream or current. It must not be assumed that the direction of the current

will not vary from that indicated by the arrow. In the same manner the velocity of the current constantly varies with circumstances, and the rate given on the chart is a mean value, corresponding to an average range of tide. At some stations but few observations have been made.

FIXING POSITION.—The most accurate method available to the navigator of fixing a position relative to the shore is by plotting with a protractor sextant angles between well-defined objects on the chart. This method, based on the "three-point problem" of geometry, should be in general use.

In many narrow waters, also, where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore. For its successful employment it is necessary, first, that the objects be well chosen; and, second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice.

Near objects should be used either for bearings or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn. On the other hand, distant objects should be used for direction because less affected by a small error or change of position. The three-arm protractor consists of a graduated circle with one fixed and two movable radial arms. The zero of the graduation is at the fixed arm, and by turning the movable arms each one can be set at any desired angle with reference to the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges in case of a metal instrument, or the radial lines in the case of a transparent or celluloid instrument, pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole. The tracing-paper protractor, consisting of a graduated circle printed on tracing paper, can be used as a substitute for the brass or celluloid instrument. The paper protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through the three objects, it will be indeterminate, as it will plot all around the circle. An approach to this condition, which is called a "revolver," must be avoided. In case of doubt select from the chart three objects nearly in a straight line or with the middle object nearest the observer. Near objects are better than distant ones, and, in general, up to 90° , the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer, the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation. A single angle and a range give, in general, an excellent fix, easily obtained and plotted.

THE COMPASS.—It is not intended that the use of the compass to fix the position should be given up. There are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. Where accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal or of additions to a chart, as fresh soundings or new buildings. In such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained prevent any errors. When only two objects are visible, a sextant angle can be used to advantage with the compass bearings and a better fix obtained than by two bearings alone.

DOUBLING THE ANGLE ON THE BOW.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance

run between the times of taking the two bearings, gives the maximum of accuracy and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam the position is obtained. By taking the bearings at two points and four points on the bow a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam. Such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in case of being suddenly shut in by fog. A graphic solution of the problem for any two bearings of the same object is frequently used. The two bearings are drawn on the chart, and the course is then drawn by means of the parallel rulers, so that the distance is measured from the chart between the lines is equal to the distance made good by the vessel between the times of taking the bearings.

DANGER ANGLE.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, charts compiled from early Russian and Spanish sources, referred to in a preceding paragraph, should not be used.

SOUNDINGS.—In thick weather, when near or approaching the land or danger, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By marking the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined.

SUMNER'S METHOD.—Among astronomical methods of fixing a ship's position the great utility of Sumner's method should be well understood, and this method should be in constant use. The Sumner line—that is, the line drawn through the two positions obtained by working the chronometer observation for longitude with two assumed latitudes, or by drawing through the position obtained with one latitude a line at right angles to the bearing of the body as obtained from the azimuth tables—gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. If directed toward the coast, it marks the bearing of a definite point; if parallel with the coast, the distance of the latter is shown. Thus, the direction of the line may often be usefully taken as a course. A sounding at the same time with the observation may often give an approximate position on the line. A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The Sumner lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day, and in combination with the sun gives an excellent fix.

RADIO COMPASS positions are especially valuable at night during fog or thick weather when other observations are not obtainable. For practical navigating purposes radio vibrations may be regarded as traveling in a straight line from the sending station to the receiving station. Instruments for determining the bearing of this line are now available. The necessary observations may be divided into two general classes: First, where the bearing of the ship's radio call is determined by one, two, or more radio stations on shore and the resulting bearing or position is reported to the vessel (see p. 10, Radio Service); secondly, where the bearings of two or more known shore radio stations are determined on the vessel itself and plotted as cross bearings. Experiments show that these bearings can be determined with a probable error of less than 2° , and the accuracy of the resulting position is largely dependent on the skill and care of the observer. It must be remembered, however, that these lines are parts of great circles, and if plotted as straight lines on a Mercator chart a considerable error may result when the ship and shore station are a long distance apart. The bearings may be corrected for this distortion, or still greater accuracy may be obtained by plotting the observed bearings on a special chart on the gnomonic projection.

Radio bearings may be combined with position lines obtained from astronomical observations and used in ways very similar to the well-known Sumner line when avoiding dangerous shoals or when making the coast.

For plotting radio compass bearings the U. S. Coast and Geodetic Survey publishes three plotting charts, which may be obtained by application to the Director, Coast and Geodetic Survey, Washington, D. C., or the sales agents, price 20 cents each. Full directions for using them are printed on the reverse side of each chart.

CHANGE OF VARIATION OF THE COMPASS.—The gradual change in the variation must not be forgotten in laying down positions by bearings on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are reengraved for every new edition if the error is appreciable. Means for determining the amount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

The change in the magnetic variation in passing along some parts of the coast of the United States is so rapid as to materially affect the course of a vessel unless given constant attention. This is particularly the case in New England and parts of Alaska, where the lines of equal magnetic variation are close together and show rapid changes in magnetic variation from place to place, as indicated by the large differences in variation given on neighboring compass roses.

LOCAL MAGNETIC DISTURBANCE.—The term "local magnetic disturbance" or "local attraction" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places. Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centers near together. The law which has hitherto been found to hold good as regards local magnetic disturbances is, that north of the magnetic equator the north end of the compass needle is attracted toward any center of disturbance; south of the magnetic equator it is repelled. It is very desirable that whenever an area of local magnetic disturbance is noted the position should be fixed and the facts reported as far as they can be ascertained.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING WAVES.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted and the application simple. The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil skillfully applied may prevent much damage both to ships (especially of the smaller classes) and to boats by modifying the action of breaking seas. The principal facts as to the use of oil are as follows:

1. On free waves—i. e., waves in deep water—the effect is greatest.
2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances, but even here it is of some service.
3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, and generally waste oil from the engines, have great effect.
4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.
5. It is useful in a ship or boat, either when running or lying-to or in wearing.
6. No experiences are related of its use when hoisting a boat at sea or in a seaway, but it is highly probable that much time would be saved and injury to the boat avoided by its use on such occasions.
7. In cold water the oil, being thickened by the lower temperature and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to facilitate leakage of the oil. The oil is also frequently distributed from canvas bags or oakum inserted in the closet bowls. The positions of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow; e. g., from the cathead and allowed to tow in the water. With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter. Lying-to, the weather bow, and another position farther aft seem the best places from which to hang the bags, using sufficient line to permit them to draw to windward while the ship drifts.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect can not be so much trusted. On a bar with the ebb tide running it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck it is recommended to pour oil overboard to windward of her before going alongside. The effect in this must greatly depend upon the set of the current and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat and the bag readily hauled on board for refilling, if necessary.

USE OF SOUNDING TUBES.

Although of undoubted value as a navigational instrument, the sounding tube is subject to certain defects which, operating singly or in combinations, may give results so misleading as to seriously endanger the vessels, whose safety is entirely dependent upon an accurate knowledge of the depths. Efforts have been made from time to time by the Coast and Geodetic Survey to utilize tubes surveying operations. A tube recently designed by this bureau, and now undergoing tests by surveying parties, gives promise of results far exceeding in accuracy any other type of tube. There are various types of tubes in common use which are too well known to require detailed description here. They are all based on the general principle that air is elastic and can be compressed, and that if a column of air in a tube be lowered into the water in such a way that the air can not escape, yet at the same time, the pressure of the water can be transmitted to it, the amount by which the air is compressed furnished a measure of the depth to which it was lowered. Theoretically this principle is sound, but when we come to apply the theory to actual practice certain elements enter which result in errors in the depth determination. It is important to note that the amount of these errors depends on the depth; the greater the depth the greater the numerical value of the error. The causes which produce these errors are as follows:

1. In order to give correct results, the bore of the tube must be exactly cylindrical. In other words, the volume of air in any 1 inch of length of the tube must be exactly the same as in an inch in any other part. But because of the way in which glass tubes are made it is very difficult to accomplish this. The bore may taper slightly or vary in other ways from a true cylinder. If tapering, the minimum diameter of bore may be at the top, middle, or bottom of the tube as submerged. If the minimum diameter be at the top, the tube will register depths less than the actual depths of water, and if at the bottom the registered depth will be greater than the true depth. This defect may be detected in a suspected tube by introducing a small quantity of mercury into the tube and comparing its length at different points along the bore. For satisfactory results the length of this column should not vary more than 5 per cent.

2. In order that even a perfect tube should give accurate results, the conditions of barometric pressure and air and water temperatures under which the sounding is being taken must be the same as those under which the scale for reading the depths was made. In making the scale a barometric pressure of 29 inches is usually assumed as normal. Then, if in actual use, the barometer registers above normal, the air in the tube is already partly compressed, and when lowered to any given depth the amount of compression due to water

pressure is correspondingly diminished. With a barometer below normal the reverse is true, and it therefore follows that when the barometer reads above normal the tubes will register less than the true depths, whereas if the barometer reads below normal the registered depths will be greater than the true. The amount of error introduced from this cause is about 3 per cent of the depth for each inch of barometric pressure above or below normal.

The density of the air in the tube also depends directly upon its temperature. Therefore, the difference between the temperature of the air in the tube before and after submergence will affect the accuracy of the sounding. Where the temperature of the tube in the air is greater than that of the tube in the water, the depth recorded will be greater than the actual depth, and, conversely, when the temperature of the air is lower than that of the water the depth recorded will be less than the true depth. Also, the temperature of the water may vary at different depths, so that the actual amount of this error depends on the difference between the temperatures of the tube in the air and at the bottom. The amount of error introduced from this cause is about 1 per cent of the depth for each 3° F. difference in temperature.

3. While the tubes are usually 24 inches long and the scales are designed for that length of tube, the manner of closing the upper end of the tube may introduce an error. The thickness of the caps used for this purpose varies considerably in different makes of tubes, even when such caps are made of the same material. This variation in thickness results in moving the tube slightly up or down in the scale. Thus, with a thin cap the sounding read from the scale will be too deep; with a thick cap, the sounding read will be less than the true depth.

Copper caps put on with sealing wax have been found to vary sufficiently to produce errors of about 5 per cent of the depth in depths of 50 to 70 fathoms. Rubber caps seem to be more nearly uniform and to give better results when new. Rubber, however, deteriorates, and when used too long there is apt to be leakage of air. When removable caps are used, care should be taken to see that they are pushed home thoroughly before sounding.

4. The integrity of the air in the tube should be carefully preserved. Even a slight leakage of air will result in showing a sounding considerably in excess of the true depth. Vessels sometimes approach dangers coming from depths of over 100 fathoms. As they approach they begin feeling for the bottom, sounding at infrequent intervals to pick up depths of 75 to 100 fathoms. So long as they get no bottom in such depths navigators feel secure. But a leaky tube may show no bottom at 100 fathoms when the ship is actually in much less depths, possibly resulting in disaster before the error is discovered. Special precautions should, therefore, be taken on this point. Copper caps should be sealed in place with sealing wax, and rubber caps should be supplied with wire clamps, giving a tight fit.

5. Accumulated salt on the inner surface of the tube will cause the water-mark to creep up and register greater than true depths. The type of tube exemplified by the well-known Bassnett sounder is based on the same principle as the ordinary glass tube, but is more complicated in design. It consists, essentially, of a metal case containing a glass tube closed at the upper end. Inside the glass tube is a metal tube, through which the water enters and is trapped by a valve at the top of the metal tube. In this device the scale is graduated directly on the glass tube, thus eliminating those errors due to thickness of cap; but, on the other hand, the possibility of errors increases directly with the number of working parts of which the sounder is made. In using sounders of this type care should be exercised to preserve perfectly gasketed joints between the bottom of the glass tube and the metal case and to keep the outlet valve well oiled and water-tight.

Leaking valves and water remaining in the tube before a sounding is taken will give increased depths, while deficient depths may be recorded as a result of loss of water through suction at the inlet as the tube is being reeled in. The Bassnet type, in common with all other forms of pressure tube, is subject to the above-described errors due to variations in temperature and barometric pressure.

It will be noted that wherever the amount of the various errors can be stated they are all small. Their importance lies in the fact that two or more of them acting together, may result in considerable errors. As already stated, actual experiments show that errors of 10 to 12 per cent are not uncommon and that

considerably greater errors may occur. There are certain precautions which can be taken to eliminate or reduce these errors:

1. In purchasing tubes a type should be selected which can be used until broken or lost. The navigator can then make a study of the results obtained from each individual tube and thus gain a fair idea of its accuracy under known conditions. This necessitates some permanent means of identifying the various tubes used, which may readily be accomplished in the case of the glass tubes by means of various colored paints or threads.

2. Before undertaking the sounding necessary to make any particular land-fall the vessel should be stopped for an up-and-down cast of the lead in order to test the accuracy under the prevailing conditions of the tubes which are to be used. For this purpose it is not necessary to get bottom; simply run out 60 to 80 fathoms of wire and then see how closely the tubes register that amount. A number of tubes can be sent down at one time, and it is then possible to select one or two which register most nearly correct. It is well to keep a permanent record of the results of each tube tested. By so doing the navigator will soon obtain valuable information as to the performance of the various tubes and the degree to which they may be trusted. Such a record should, of course, take into account the various conditions affecting the result. It will be noted that the factors which produce errors may be divided roughly into three groups:

(a) *Inherent*: Those which occur as a result of permanent defects in the tube, such as the variation of the bore from a true cylinder, variation in the thickness of the cap, etc.

(b) *External*: Those which occur as a result of the conditions under which the sounding was taken, variations of temperature or barometric pressure from the normal, etc.

(c) *Accidental*: Those which affect a single sounding, due to the failure of the tube to register properly, leakage of air, loss of water from leaky valve, errors due to the presence of salt in the tube, etc.

These accidental errors are probably the most serious of the three types, both because they are apt to be larger in amount and because it is impossible to foresee when they will occur. But, on the other hand, they occur only as a result of a few known causes, already enumerated, and therefore by the exercise of proper caution in the use of the tubes that they may be to a large extent eliminated. If the ordinary glass tube is used, see that the bore is thoroughly dry and free from salt and that the cap makes a tight fit. If using a sounder, see that the tube is free from water and that the valves are tight and well oiled. And, above all, during the course of the sounding take an occasional up-and-down cast as a check, for by that means alone can one be sure that the proper results are being obtained.

The smallest possible number of tubes should be used. It is obviously much better to use over and over again one tube which is giving good results than to use a number whose errors are uncertain. This is particularly desirable where sounders involving valves are used. If a tube shows no bottom at 100 fathoms, examine the arming to make sure that the lead actually failed to find bottom.

Finally, beware of overconfidence. Tubes which have been working properly for a number of soundings suddenly develop errors. It is chiefly for this reason that they have been discarded for surveying operations. Assuming that the accidental errors can be reasonably controlled, the inherent and external errors present no serious difficulty.

As already indicated, the bore of a tube (or at least of any tube which is capable of constant use) can be tested with mercury, and those tubes rejected which show variations in bore greater than about 5 per cent. Errors due to variations in the thickness of caps can be eliminated by using a scale graduated for a true length of 24 inches (the length of the glass tube) and removing the cap before the sounding is read. Errors due to differences between air and water temperatures can be reduced to a minimum which can usually be neglected by immersing the tube before using in a bucket of sea water newly drawn, so that its temperature has not had time to change. Care should, of course, be taken to see that no water enters the tube. When this is done, there may still remain an error due to the difference in temperature of the water at the surface and at the bottom. This may, if desired, be corrected by sending down a self-registering thermometer with the lead, but for the ordinary

purposes of navigation this is a refinement which may be ignored. There is no ready method available for correcting the error due to variations in the barometric pressure. The correction should be applied to the sounding recorded.

It is interesting to note that sounding tubes which give good results can readily be made from plain glass or metal tubes aboard ship—gauge glasses, for instance. One end of the tube is closed with a cork and sealing wax. A narrow strip of chart paper of uniform width, on which a line has been ruled with an indelible pencil, is inserted the entire length of the tube. The paper is held in place by bending the projecting lower end upward along the outside of the tube and securing it with a rubber band. The height in which the water rises in the tube will be indicated by the blurring of the pencil line.

If the air column in the tube is 24 inches long, the sounding may be read from any scale graduated for tubes of that length. If of a different length, a special scale must be prepared; its graduations, compared to those of the 24-inch scale, will be proportional to the comparative lengths of the two tubes. If certain precautions are taken, these tubes will give results which compare favorably with commercial tubes. The paper should be inserted uniformly in the tube, and its upper end, or a mark from which the measurement is taken, should coincide with the top of the air column. Metal tubes have the advantage of uniform bore; but if metal tubes are used, the paper, in order to insure uniformity, should be fastened at the upper end when that end is being sealed and then stretched lightly at the bottom. The depth should always be read from the dry position of the paper, as the wet portion is subject to considerable change in length.

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FIELD STATIONS.

Boston, Mass., Appraisers Building, 408 Atlantic Avenue.
 New York, N. Y., 311-12, Maritime Exchange Building, 78 Broad St.
 New Orleans, La., room 314, Customhouse.
 San Francisco, Calif., room 305-6, Customhouse.
 Seattle, Wash., room 202, Burke Building.
 Manila, P. I., Intendencia Buildings.

At these stations complete files of the United States Coast and Geodetic Survey charts, Coast Pilots, Tide Tables, Current Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge. Light Lists, Buoy Lists, and Notices to Mariners are kept for sale or for free distribution to mariners. The field stations are also sales agencies for the Coast and Geodetic Survey publications. A chart catalogue, giving lists of charts, coast pilots, tide table, and agencies of the Coast and Geodetic Survey, can be obtained from any of the field stations, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

ANCHORAGE GROUNDS IN HAMPTON ROADS AND THE HARBORS OF NORFOLK AND NEWPORT NEWS, VA., AND RULES AND REGULATIONS RELATING THERETO.

THE ANCHORAGE GROUNDS.

[All azimuths are referred to a true meridian.]

Under authority of the provisions of section 7 of the river and harbor act approved March 4, 1915, the following anchorage grounds for vessels in Hampton Roads and the harbors of Norfolk and Newport News, Va., are hereby defined and established, and the following rules and regulations relating thereto are adopted.

TEMPORARY ANCHORAGE A.

Hampton Bar.—To the westward of a line bearing 8° from a point ("A") determined by the following cross bearings: Old Point Comfort light, bearing 31° ; flagstaff on Fort Wool, bearing 100° ; to the northward of a line bearing 229° from point "A" to a point ("B"), 425 yards distant; to the northeastward of a line bearing 289° from point "B."

NOTE.—This area is reserved for the use of vessels while undergoing examination by quarantine, customs, and immigration authorities. Upon completion of these examinations vessels shall move promptly to a regular anchorage area.

The master of every steam vessel using this temporary anchorage shall keep his vessel in condition to move promptly under her own power upon notification by the captain of the port, and, when any such vessel is in charge of a pilot, the pilot shall remain on board until the vessel is safely anchored in a designated anchorage area. No sailing vessel using this anchorage shall be left unattended by a steam tugboat while undergoing examination by any of the authorities mentioned in paragraph two hereof, except when her stay is likely to be of several hours duration, when she shall be anchored in the western part of this temporary anchorage out of the way of other vessels before the tug and pilot leave her.

No master of a vessel awaiting or undergoing quarantine inspection shall release any part of the crew until the vessel has been passed by the proper quarantine officials and safely anchored or moored in one of the designated areas.

ANCHORAGE B.

*Naval anchorage.*¹—To the southward of a line bearing 289° from point "B" defined under Temporary Anchorage A; to the westward of a line bearing 229° from point "B" defined under Temporary Anchorage A; to the northward of a line bearing 292° from the northernmost of the two towers on the west side of the Jamestown Exposition Pier, Naval Operating Base, Sewall Point.

NOTE.—This area is reserved for the use of naval vessels, but, in the absence of the fleet, the captain of the port may, in his discretion, permit it to be used by merchant vessels. Upon receiving word that any part of the fleet is expected, the captain of the port shall cause a sufficient area in this anchorage, and also in Anchorage C, to be vacated to accommodate the number of vessels scheduled to arrive.

ANCHORAGE C.

*Newport News Bar.*¹—To the southward of the southern boundary of Anchorage B; to the westward of an extension of the line forming the eastern boundary of Anchorage B; to the northward of a line running through the red buoys marking the 35-foot dredged channel to Newport News; to the eastward of a line bearing north through red gas buoy No. 8, at the western entrance to the old Newport News channel.

¹ The established anchorages for naval vessels having been found inadequate at times when an especially large number of vessels are gathered for parade or other purpose, and the Navy Department having requested the establishment of a numbered series of anchorages for such occasions in order that a naval vessel may be ordered to proceed to a designated numbered anchorage in the harbor, the following arrangements have been made: A key chart for naval anchorages in Hampton Roads, which provides for the emergent anchorage of naval vessels in Anchorages A, C, E, and G, and also in the vicinity of Thimble Shoal, marked Anchorage "X" on the key chart, has been prepared. These designated anchorages, with the exception of those in Naval Anchorage B, which are primarily for naval vessels, are not set aside for the exclusive use of naval vessels, but permission will be given for naval vessels to use them when available. When the captain of the port receives notification from the proper naval authorities that it is desired to utilize certain of these specially numbered anchorages, he will authorize the use by naval vessels of the requested numbers, if they can be made available, the commercial conditions at the time being given proper consideration. If, in the opinion of the captain of the port, there are sufficient reasons why the numbers first asked for should not be used, he will confer with the naval officers making the request, and if other numbers can be agreed upon he will authorize their use; otherwise he will communicate the request to the Secretary of War with a statement of the circumstances and with his recommendations.

ANCHORAGE D.

The area inclosed by lines drawn as follows: From gas buoy No. 1 at the entrance to the Newport News dredged channel to bell buoy No. 2, at the entrance to Norfolk dredged channel; thence 229° to a point where buoy S 25H bears 250°; then on that bearing until Newport News Middle Ground Light bears 3°; thence bearing 3° for a distance of 775 yards to anchorage buoy E; thence bearing 49° on a line in extension of the southeast boundary of Anchorage B to intersection with the first line.

NOTE.—This area is to be used by deep-draft vessels, wind-bound vessels from Lambert Point and Sewall Point, and vessels awaiting turn for docking. Other vessels may use this anchorage when permitted by the captain of the port.

ANCHORAGE E.

Middle Ground Anchorage.—To the southward of a line running through the black buoys marking the southern edge of the 35-foot dredged channel to Newport News; to the westward of the northwest boundary line of Anchorage D; to the northeastward of a line bearing 310° from the southwest end of the northwest boundary line of Anchorage D.

ANCHORAGE F.

Anchorage for explosives and other dangerous articles.—To the southward of a line, bearing 310°, through two points determined by the following cross bearings: Easterly point, Newport News Middle Ground light, bearing 20°; Craney Island light, bearing 131°; Nansemond River light, bearing 243°; westerly point, Newport News Middle Ground light, bearing 89°; Nansemond River light, bearing 219°; northern red light on the railroad pier at Newport News, bearing 327° 45'. To the westward of a line bearing 183° through the above easterly point; to the eastward of a line bearing 183° through the above westerly point. The southwesterly limit of Anchorage E is the northern boundary of the forbidden area around Anchorage F.

NOTE.—All vessels are forbidden to anchor between the northern boundary line of Anchorage F and the southwestern boundary line of Anchorage E or within a zone 425 yards wide on the eastern and the western sides of Anchorage F.

ANCHORAGE F-1.

Anchorage for vessels carrying explosives and other dangerous articles and having drafts too great to permit them to use Anchorage F.—An area within Anchorage C to the westward of the eastern boundary of Anchorage C; to the northward of a line bearing 292° from the southeasterly corner of Anchorage C 1,800 yards; to the eastward of a line bearing 49° to a point in the northern boundary of Anchorage C 1,800 yards distant from the easterly corner of Anchorage C; to the southward of the northern boundary of Anchorage C.

NOTE.—When Anchorage F-1 is not occupied by vessels carrying explosives, it may be used as a general anchorage in the same manner as other portions of Anchorage C, except that it must be vacated upon notice from the captain of the port when a vessel of a draft too great to permit it to use Anchorage F carrying explosives desires to anchor.

When Anchorage F-1 is occupied by a vessel carrying explosives, vessels shall not anchor in Anchorages B or C within a zone 425 yards wide on all sides of the area. No vessel carrying explosives shall be anchored in area F-1 so as to swing within 500 yards of the Newport News dredged channel.

ANCHORAGE G.

Newport News.—To the southward of the following lines: From Fishing Point to black can buoy No. 3 off Naseway Shoal; thence to a point fixed by the following cross bearings: Northern red light on railroad pier, Newport News, bearing 185°; Nansemond River light, bearing 180°; thence to a point determined by the following cross bearings: Northern red light on railroad pier, Newport News, bearing 45°; Newport News Middle Ground light, bearing 119°; Nansemond River light, bearing 189° 35'; thence 145° to intersect an extension of the line marking the northern boundary of Anchorage E; thence easterly to the westerly point of Anchorage E. To the westward of a line parallel to and 425 yards west of the western boundary of Anchorage E.

ANCHORAGE G-1.

James River.—To the northwestward of a line bearing 60° through can buoy No. 3 off Naseway Shoal; to the northward of a line bearing 121° through White Shoal light; to the eastward of a line bearing 30° through White Shoal light.

ANCHORAGE H.

Craney Island Flats.—To the southward of the lines forming the southern boundary of Anchorage D; to the westward of a line passing through the red buoys marking the western side of the channel to Norfolk; to the northward of a line passing through Craney Island light and tangent to the north shore of Craney Island; to the eastward of a line parallel to and 425 yards easterly of the eastern boundary of Anchorage F.

ANCHORAGE H-1.

West Norfolk.—To the southward of the line forming the southern boundary of Anchorage H; to the westward of a line passing through the red buoys marking the westward side of the channel to Norfolk; to the northwestward of a line through beacon No. 2 and nun buoy No. 2 on the north side of the Western Branch Channel; to the northeastward of a line passing through beacon No. 2 and high stack in West Norfolk.

NOTE.—No vessel after receiving its load shall remain more than 12 hours in this anchorage, except by special permit from the captain of the port.

ANCHORAGE J.

Sewall Point.—To the southward of a line bearing 87° from gas buoy 3A at the northern entrance of the channel to Norfolk; to the northward of a line bearing 282° from the northwestern corner of the submarine basin, naval operating base; to the eastward of a line through the black buoys marking the eastern side of the channel to Norfolk.

ANCHORAGE K.

Bush Bluff Shoal.—To the southward of lines running 87° and 220° , respectively, from spar buoy No. 2, marking the southern edge of the channel to Virginia Railway coal pier at Sewall Point; to the northward of a line bearing 112° from black spar buoy No. 9A off Lambert Point; to the eastward of a line through the black buoys and bell buoy 3BB marking the eastern side of the channel to Norfolk.

ANCHORAGE L.

Lambert Point.—To the southeastward of a line bearing 51° from black spar buoy No. 11-L off Lambert Point; to the northwestward of a line bearing 51° from black spar buoy No. 13 off Lambert Point Creek; to the northeastward of a line through black spar buoys No. 11-L and No. 13 marking the eastern side of channel to Norfolk.

ANCHORAGE M.

To the southeastward of a line bearing 47° , 75 yards southeastward of the southernmost pier of the Norfolk & Western Railway on the east side of the channel to Norfolk; to the northeastward of two lines, one through the black spar buoys marking the eastern side of the channel to Norfolk and the other bearing 109° from black spar buoy No. 15.

ANCHORAGE N.

Atlantic City.—To the northeastward of a line running from the westerly end of the New York, Philadelphia & Norfolk Railroad pier in Norfolk to the southerly end of the pier at Fort Norfolk; and between two lines at right angles to above line, one passing 200 feet northward of the Chesapeake & Ohio Railroad pier in Norfolk and the other passing 109 feet southeast of the Nottingham & Wrenn pier; and to the southward of a line drawn 100 feet north of and parallel to an extension of the north side of West Freemason Street.

ANCHORAGE N-1.

Smith Creek.—Mowbray Arch: Between Mowbray Arch and a line described as follows: Beginning at Ghent Bridge, 150 feet from Mowbray Arch, and continuing westerly the same distance therefrom to the intersection of the prolongation of the east side of Colonial Avenue; thence in a straight line to a point on the south side of Mill Street prolonged and 70 feet from Mowbray Arch; thence parallel to and 70 feet from Mowbray Arch to the south side of Pembroke Avenue prolonged; thence along the prolongation of the south side of Pembroke Avenue prolonged; thence along the prolongation of the south side of Pembroke Avenue to a point 50 feet from Mowbray Arch; thence in a straight line to a point on the south side of Fairfax Avenue prolonged and 40 feet from Mowbray Arch. The Hague: Between the wall on the west side of the Hague and the straight line joining the point 40 feet easterly thereof in the south side of Fairfax Avenue prolonged, with the point 70 feet easterly from the wall in the perpendicular to the wall at the south end thereof.

NOTE.—No floats, rafts, lighters, houseboats, or craft laid up for any reason shall be permitted within the Smith Creek anchorages, except by permission of the captain of the port. No vessel shall anchor or moor alongside any wharf or pier on Smith Creek, so as to extend more than 40 feet beyond the pierhead line, except in the authorized anchorages.

ANCHORAGE O.

Hospital Point.—To the south westward of a line through the red buoys marking the western side of the channel to Norfolk; to the southward of a line bearing 242° from north tower elevators at Atlantic City.

ANCHORAGE P.

Port Norfolk.—To the southeastward of a line bearing 37° from the northeast corner of the New York, Philadelphia & Norfolk Railroad piers at Port Norfolk; to the southwestward of a line through the red buoys marking the southwestern side of channel to Norfolk; to the northwestward of the outside bulkhead at the north end of Pinner Point and its northeasterly extension.

ANCHORAGE Q.

The area known as Spotico Creek Flats landward of the United States pierhead line and not within 200 feet of wharves or other permanent improvements.

ANCHORAGE R.

The area landward of the United States pierhead lines on the south side of the Eastern Branch of the Elizabeth River extending from a point 700 feet to the eastward from the Norfolk & Western Railway bridge to a point 250 feet from the Virginian Railway bridge and not within 200 feet of permanent improvements: *Provided*, That no vessel shall anchor within 100 feet of the eastern and western entrances of Steamboat Creek or in a position that will obstruct passage thereto.

ANCHORAGE S.

The area landward of the United States pierhead lines on the northern side of the Eastern Branch of the Elizabeth River, and from a point 250 feet from the Campostella Bridge to the western entrance of Broad Creek, and not within 200 feet of permanent improvements.

THE RULES AND REGULATIONS.

1. Except in cases of great emergency, no vessel shall be anchored in Hampton Roads or the harbors of Newport News and Norfolk, Va., outside of the anchorage areas hereby defined and established, nor be made fast to the exterior end of any pier, nor to any vessel lying at the exterior end of any pier, or along any bulkhead in such manner as to obstruct or endanger the passage of any vessels to or from the adjacent wharf property, or impede the movements of any vessel entering or leaving adjacent slips.

2. Whenever, in the opinion of the captain of the port, such action may be necessary, that officer may require any or all vessels in any designated anchorage area to moor with two or more anchors.

3. Every vessel whose crew may be reduced to such number that it will not have sufficient men on board to weigh the anchor at any time shall be anchored

with two anchors, with mooring swivel put on before the crew shall be reduced or released.

4. Anchors must not be placed outside the anchorage areas, nor shall any vessel be so anchored that any portion of the hull or rigging shall at any time extend outside the boundaries of the anchorage area.

5. Any vessels anchoring under the circumstances of great emergency outside of the anchorage areas must be placed near the edge of the channel and in such position as not to interfere with the free navigation of the channel, nor obstruct the approach to any pier nor impede the movement of any boat, and shall move away immediately after the emergency ceases, or upon notification by the captain of the port.

6. The captain of the port shall assign berths in the anchorages to all vessels applying. He may grant permits for habitually maintaining and using the same mooring place in an anchorage area, and no vessel shall occupy a permanent berth in an anchorage area, except under authority of such permit, which may be revoked at any time.

7. A vessel upon being notified to move into the anchorage limits or to shift its position on anchorage grounds must get under way at once or signal for a tug and must change position as directed with reasonable promptness.

8. Except as provided in rule 10, vessels carrying explosives or other dangerous articles including inflammable liquids, inflammable solids, oxidizing materials, corrosive liquids, compressed gasses, and poisonous substances shall be anchored within the anchorage area F and F-1 only, described above under the heading "The Anchorage Grounds." Anchorage F is reserved for this special purpose and is not to be used by vessels carrying other classes of freight except in cases of emergency.

Any vessel carrying explosives and desiring to proceed to the anchorage provided therefor must first obtain a written permit from the captain of the port; and no vessel shall occupy a berth in such anchorage except by authority of such permit, which may be revoked at any time. All other vessels, especially tugs and stevedores' boats, engaged or used in connection with loading explosives on vessels in anchorage areas must carry written permits from the captain of the port and must show these permits whenever required by the captain of the port or his properly authorized agents.

9. Whenever any water craft not fitted with mechanical power anchors in Anchorage F while carrying explosives, the captain of the port may require the attendance of a tug upon such water craft, when in his judgment such action is deemed necessary.

10. The district engineer in charge of works of river and harbor improvement is empowered to authorize, in writing, the anchoring in or near the vicinity of such a work of a single scow carrying explosives for use on the work, but only in quantities considered by him safe and necessary. The district engineer shall prescribe the conditions under which this explosive shall be stored and handled and shall in each case furnish the captain of the port with a copy of the written permit to anchor explosives on the work and a copy of the rules and regulations for its storage and handling.

11. Municipal ash scows may be anchored in such places as the captain of the port may designate.

12. Whenever the maritime or commercial interests of the United States so require, the captain of the port is hereby empowered to shift the position of any vessel anchored within the anchorage areas, of any vessel anchored outside the anchorage areas, of any vessel which is so moored or anchored as to impede or obstruct vessel movements in any channel or obstruct or interfere with range lights, and of any vessel which, lying at the exterior end of a pier or alongside an open bulkhead, obstructs the passage of vessels to or from adjacent wharf property or impedes the movements of vessels entering or leaving adjacent slips.

13. Permits to anchor in channels within the limits of Hampton Roads and the harbors of Norfolk and Newport News, Va., may be granted by the captain of the port to wrecking plants legally engaged in recovering sunken property, when the application for such anchorage is approved by the district engineer in charge of works of river and harbor improvements.

14. Nothing in these rules and regulations shall be construed as relieving the owner or person in charge of any vessel from the penalties of the law for obstructing navigation or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights, fog signals, or for otherwise violating law.

REGULATIONS GOVERNING THE USE AND NAVIGATION OF THE WATERS OF HAMPTON ROADS AND THE HARBORS OF NORFOLK AND NEWPORT NEWS, VA., AND THE HANDLING OF EXPLOSIVES THEREIN BY VESSELS OTHER THAN COMMON CARRIERS CARRYING EXPLOSIVES.

Under authority of section 7 of the river and harbor act approved August 8, 1917, the following regulations are prescribed to govern the use and navigation of the waters of Hampton Roads and the harbors of Norfolk and Newport News, Va., by vessels, other than common carriers, carrying explosives:

1. The officer of the Coast Guard designated "Captain of the port" shall have immediate supervision of the enforcement of these regulations.

2. Vessels carrying explosives shall be at all times in charge of competent persons and must display by day a red flag of at least 16 square feet at the masthead, or at least 10 feet above the upper deck, if the vessel has no mast; at night a red light will be displayed in the same positions specified for the red flag. For use in emergencies each barge must be provided with a suitable anchor, ground tackle, and equipment, to be approved by the captain of the port; with an adequate supply of fire extinguishers, and fire pails filled with water, and with a suitable fog-horn and bell.

3. No smoking will be permitted on or near any vessel, barge, or scow carrying explosives, and no person under the influence of liquor will be allowed on board, nor to approach such vessels. Every person having business on board vessels which are being loaded with explosives, other than members of the crew, must have a pass from the captain of the port in such form as the captain of the port shall determine.

4. Vessels carrying explosives shall not carry inflammable liquids, inflammable solids, oxidizing materials, mineral acids, as defined in Interstate Commerce Commission regulations for the transportation of explosives, or articles likely to ignite spontaneously, or to give off inflammable gases, unless the explosives are stored in separate rooms or are otherwise so separated as to effectually prevent danger to the explosive from any of these articles, or from the vapor thereof. Where blasting caps, detonating fuses, and fulminate of mercury in bulk are loaded on the same vessel with high explosives, they must be in a different compartment, the distance in a straight line from the compartment containing them to the explosives to be not less than 25 feet.

5. No unnecessary fires shall be permitted on vessels carrying explosives, and those fires which are deemed necessary must be properly safeguarded and must be left in constant charge of some one individual of the crew during the entire period that they are burning. Cabins on barges or lighters carrying explosives of any, or all, descriptions, in which oil lights or stoves are used must be protected by covering. The wooden walls, partitions, floors, and ceilings with two thicknesses of one-quarter inch asbestos board placed with joints broken and covered with No. 26 gauge metal. This protection must also be applied to doors, and the doors from the cabin into other parts of the boat must be provided with substantial springs, making them self-closing. The stoves must be at least 18 inches from all partitions, and a sheet-metal shield $5\frac{1}{2}$ feet in height, securely fastened to the floor and the wall, must be placed midway between the walls and the stove. The stove must be at least 6 inches from the floor of the cabin, supported either on legs permanently and securely fastened to the stove and the floor, or on 6 inches of hollow tile securely fastened in place. The hole in the roof of the cabin where the stovepipe passes through shall be 18 inches larger in circumference than the stovepipe, and a substantial metal plate shall be placed in the opening surrounding the pipe to hold it in place. The stovepipe shall also be tied into the walls so that it will not shift.

The smokestack must be provided with substantial screens of fine mesh or other satisfactory spark arrester. All oil lamps must be held in marine brackets. Safety matches of wooden-stick type rather than the paper type must be used exclusively and kept in proper receptacles. Oils and lamps must be kept on deck in a box lined with metal in such position that it can be readily thrown overboard. No artificial light shall be permitted in the holds or compartments of any vessel that contains explosives except electric flash lights or electric lanterns or an approved electric lighting of the vessel. Crews must not have or carry matches, firearms, or cartridges on their persons. Electric flashlights must be provided for the attendants.

6. No explosives will be allowed to be placed aboard a vessel until the rest of the cargo has been placed aboard and the vessel trimmed. All work of con-

struction of floors, partitions, and other conditioning of the vessel, and the removal of any other combustibles from that part of the hold in which the explosives are to be stored, shall be completed before loading of the explosives is commenced. All rubbish, shovelings, old oil, paint cans, oil rags, rope ends, and other litter must be kept cleared out of the holds. Such lumber as is allowed to remain in the holds for use as firewood must be securely piled. Floors must be kept broom clean. All decks, gangways, and holds over which explosives must be passed in loading must be freed from all loose metal or tools and carefully swept before loading is commenced and after loading has ceased.

7. All explosives must be handled carefully. No metal tools shall be used in loading, unloading, or handling explosives. Men engaged in loading, unloading, or handling explosives must not have or carry on their persons metal tools or bale hooks, matches, firearms, or cartridges, and they must not wear boots or shoes shod or strengthened with iron nails or any metal, unless such boots or shoes are covered with leather, felt, or some other such material. Packages of explosives must not be thrown, dropped, rolled, dragged, or slid over each other or over the decks. Dynamite boxes must be stowed topside up. Powder kegs should be loaded with seams up.

8. The term "high explosives in bulk" shall be construed to mean high explosives packed in boxes, barrels, or kegs, and not loaded in ammunition or shells. The standard definition of the term "high explosives" will be that contained in paragraph 1503 of the regulations of the Interstate Commerce Commission for the transportation of explosives by rail, viz: "High explosives are all explosives more powerful than ordinary black powder, except smokeless powders and fulminates. Their distinguishing characteristic is their susceptibility to detonation by a blasting cap. Examples of high explosives are dynamite, picric acid, picrates, chlorate powders, nitrate of ammonia powders, dry trinitrotoluol, dry nitrocellulose (gun cotton), dry tetranitroaniline, dry tetranitromethylaniline and fireworks that can be exploded en masse." Unless they are loaded in the same vessel with articles enumerated in the rule quoted above, picric acid 10 per cent wet, and trinitrotoluol 10 per cent wet, and nitrocellulose (gun cotton) 20 per cent wet, will not be classified as high explosives. The term "high explosives in bulk" does not include such articles as benzol, toluol, smokeless powder, black powder, small-arms ammunition, ammunition for cannon with explosive projectiles, explosive projectiles or torpedoes, percussion fuses, time fuses, combination fuses, tracer fuses, cordeau detonant, primers for cannon and small arms, blasting caps, detonating fuses, and fulminate of mercury in bulk. Blasting caps, detonating fuses, and fulminate of mercury in bulk will be considered as constituting a distinct class by themselves and must be stowed and handled with special care.

9. In transferring high explosives in bulk, blasting caps, detonating fuses, and fulminate of mercury from one vessel to another they must be handled by hand or regulation chute and mattress. If difference in elevation between vessels or condition of weather renders it impossible to transfer or load by hand or chute, mechanical hoists and a special crate or basket may be used. Explosives transferred in this manner must not be handled roughly. They must be hoisted and lowered carefully and be deposited or lowered on a mattress.

10. When an inclined chute is employed, such chute shall be constructed of 1-inch planed boards with side guards 4 inches high, extending 3 inches above top face of bottom of chute and throughout its length fastened with brass screws. D-shaped strips or runners not more than 6 inches apart and running lengthwise of the chute must be fastened to the upper surface of the bottom part by means of glue and wooden pegs extending through the bottom part and runners. Chutes must be occasionally wiped down with waste moistened with machine oil when dynamite packages are being handled. A stuffed mattress 4 feet wide by 6 feet long and not less than 4 inches thick, or a heavy jute or hemp mat of like dimensions, must be placed under the discharging end of the chute. The incline of the chute should be such that the velocity of the packages sliding will not be great enough to cause violent shock when coming in contact with other packages or when reaching the bottom of slide, or men must be stationed alongside the chutes to retard the velocity of the packages and prevent violent shocks when packages come in contact with each other or reach bottom of chute.

11. Broken or seriously damaged packages of explosives may be recovered when it is practicable and not dangerous. A broken box of dynamite that can not be recovered should be reinforced by stout wrapping paper and twine,

placed in another strong box, and surrounded by dry, fine sawdust, or dry and clean cotton waste, or elastic wads made from dry newspaper. A ruptured can or keg should be inclosed in a grain bag of good quality and boxed or crated. Injured packages thus protected and properly marked may be forwarded. Packages too seriously damaged to be recovered should not be forwarded, but set aside and the shipper notified to make disposition of them. In removing broken cases or kegs of explosives from vessels care must be taken to remove any particles of loose explosives.

12. The transportation of high explosives by water and the transfer of explosives to and from water craft in Hampton Roads and the harbors of Norfolk and Newport News shall be made under the direct supervision of such special inspectors as may be assigned for the purpose by the captain of the port, but this is not to be construed as charging the captain of the port with any responsibility in connection with the navigation of such water craft. Owners or agents of water craft transferring or carrying such cargoes will be required to provide subsistence, when crews are subsisted on board, and, when necessary, suitable sleeping accommodation for special inspectors and for guards placed on board by the captain of the port, and for such periods as he may specify. When crews are not subsisted on board, subsistence for inspectors and guards will not be required, but every opportunity will be afforded to them to use such cooking facilities as are provided for the crews.

13. In any case of violation of the regulations in regard to the handling of explosives, the captain of the port is empowered to remove any vessel, or any man or men from the waters to which these regulations pertain, or to stop the loading or unloading of explosives in said waters.

14. Nothing in the foregoing shall be construed as relieving the master of any vessel carrying explosives from the responsibility of making frequent inspections, both by day and night, to see that these rules are complied with.

INSTRUCTIONS TO MARINERS IN CASE OF SHIPWRECK AS PUBLISHED BY THE U. S. COAST GUARD SERVICE.

GENERAL INFORMATION.

Life-saving stations and houses of refuge are located upon the Atlantic and Pacific seaboard of the United States, the Gulf of Mexico, and the Lake coasts.

All stations on the Atlantic coast are manned annually by crews of experienced surfmen; upon the Lake coasts the stations are manned from the opening until the close of navigation, with the exception of the one on Beaver Island, Lake Michigan, which depends on a volunteer crew; and upon the Pacific coast they are open and manned throughout the year.

All life-saving stations are fully supplied with boats, wreck guns, beach apparatus, restoratives, clothing provided by the Women's National Relief Association for the shipwrecked requiring it, etc.

Houses of refuge are supplied with boats, provisions, and restoratives, but not manned by crews; a keeper, however, resides in each, who is required to make extended excursions along the coast after every storm, with a view of ascertaining if any shipwreck has occurred and finding and succoring any persons that may have been cast ashore.

Houses of refuge are located exclusively upon the Florida coast, where the requirements of relief are widely different from those of any other portion of the seaboard.

The life-saving stations are provided with the International Code of Signals, and vessels can, by opening communication, be reported; or obtain the latitude or longitude of the station, where determined; or information as to the weather probabilities in most cases; or, where facilities for the transmission of messages by telephone or telegraph are available, requests for a tug or Coast Guard cutter will be received and promptly forwarded.

All services are performed by the life-saving crews without other compensation than their wages from the Government.

Destitute seafarers are provided with food and lodging at the nearest station by the Government as long as necessarily detained by the circumstances of shipwreck, and, if needed, with clothing provided by the Women's National Relief Association.

The station crews patrol the beach from 2 to 4 miles each side of their stations between sunset and sunrise, and if the weather is foggy the patrol is continued through the day. A continuous lookout is also maintained at every station night and day.

Each patrolman carries Coston signals. Upon discovering a vessel standing into danger he ignites one of these, which emits a brilliant red flame of about two minutes' duration, to warn her off, or, should the vessel be ashore, to let her crew know that they are discovered and assistance is at hand.

If the vessel is not discovered by the patrol immediately after striking, rockets, flare-up lights, or other recognized signals of distress should be used. If the weather be foggy, some recognized sound signal should be made to attract attention, as the patrolman may be some distance away at the other end of his beat.

Masters are particularly cautioned, if they should be driven ashore anywhere in the neighborhood of the stations, to remain on board until assistance arrives, and under no circumstances should they attempt to land through the surf in their own boats until the last hope of assistance from the shore has vanished. Often when comparatively smooth at sea a dangerous surf is running which is not perceptible 400 yards offshore, and the surf when viewed from a vessel never appears as dangerous as it is. Many lives have been lost unnecessarily by the crews of stranded vessels being thus deceived and attempting to land in the ship's boats.

The difficulties of rescue by operations from the shore are greatly increased in cases where the anchors are let go *after entering the breakers*, as is frequently done, and the chances of saving life correspondingly lessened.

RESCUE WITH THE LIFEBOAT OR SURFBOAT.

The patrolman, after discovering your vessel ashore and burning a Coston signal, hastens to his station or the telephone for assistance. If the use of a boat is practicable, either the large lifeboat is launched from its ways in the station and proceeds to the wreck by water or the lighter surfboat is hauled overland to a point opposite the wreck and launched, as circumstances may require.

Upon the boat reaching your vessel, the directions and orders of the keeper (who always commands and steers the boat) should be implicitly obeyed. Any headlong rushing and crowding should be prevented, and the captain of the vessel should remain on board, to preserve order, until every other person has left.

Women, children, helpless persons, and passengers should be passed into the boat first.

Goods or baggage will positively not be taken into the boat until all are landed. If any be passed in against the keeper's remonstrance, he is fully authorized to throw the same overboard.

RESCUE WITH THE BREECHES BUOY OR LIFE CAR.

Should it be expedient to use either the lifeboat or surfboat, recourse will be had to the wreck gun and beach apparatus for the rescue by the breeches buoy or the life car.

A shot with a small line attached will be fired across your vessel. Get hold of the line as soon as possible and haul on board until you get a tailblock with a whip or endless line rove through it. This tailblock should be hauled on board as quickly as possible to prevent the whip drifting off with the set or fouling with wreckage, etc. Therefore, if you have been driven into the rigging, where but one or two men can work to advantage, cut the shot-line and run it through some available block, such as the throat or peak-halyards block, or any block which will afford a clear lead, or even between the ratlines, that as many as possible may assist in hauling.

Attached to the tailblock will be a tally board with the following directions in English on one side and French on the other:

"Make the tail of the block fast to the lower mast, well up. If the masts are gone, then to the best place you can find. Cast off shot-line, see that the rope in the block runs free, and show signal to the shore."

The above instruction being complied with, the result will be as shown in Figure 1.

As soon as your signal is seen a 3-inch hawser will be bent onto the whip and hauled off to your ship by the life-saving crew.

If circumstances permit, you can assist the life-saving crew by manning that part of the whip to which the hawser is bent and hauling with them.

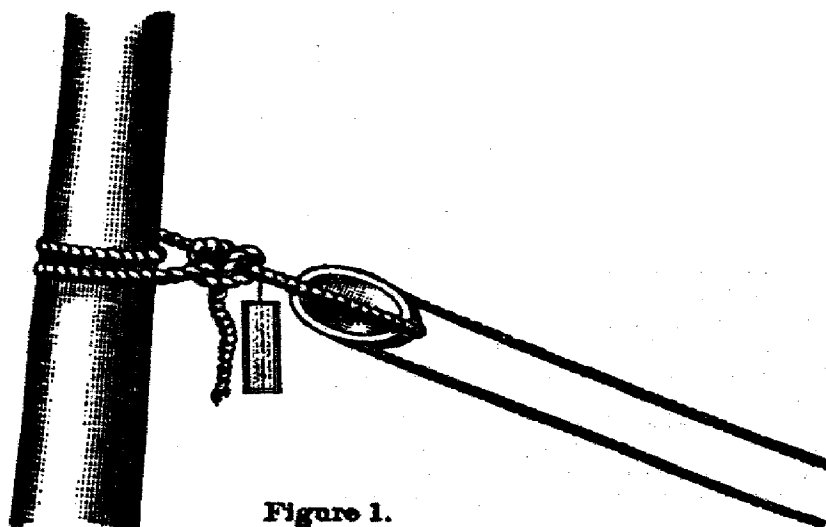


Figure 1.

When the end of the hawser is got on board, a tally board will be found attached, bearing the following directions in English on one side and French on the other:

"Make this hawser fast about two feet above the tailblock, see all clear and that the rope in the block runs free, and show signal to the shore."

These instructions being obeyed, the result will be as shown in Figure 2.

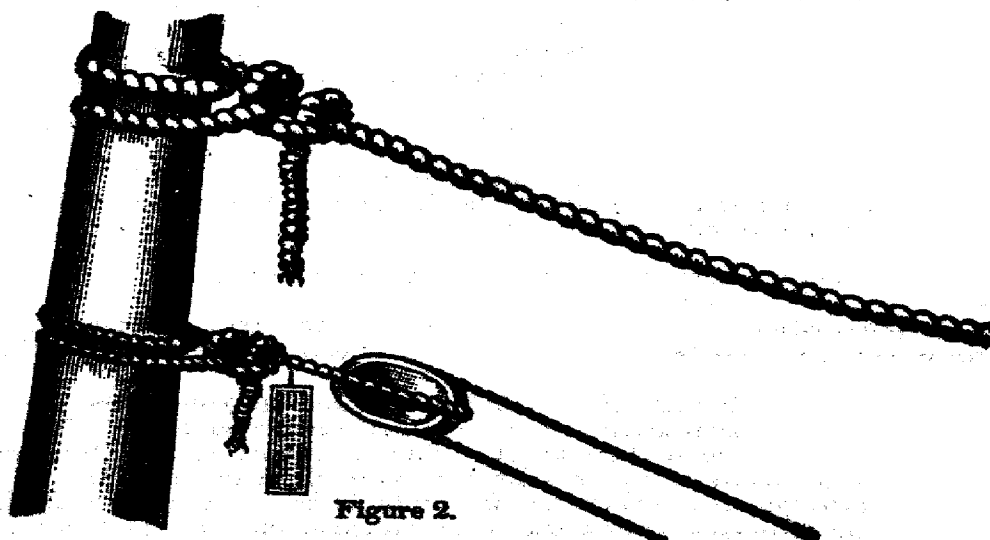


Figure 2.

Take particular care that there are no turns of the whip line round the hawser. To prevent this, take the end of the hawser UP BETWEEN the parts of the whip before making it fast.

When the hawser is made fast, the whip cast off from the hawser, and your signal seen by the life-saving crew, they will haul the hawser taut and by means of the whip will haul off to your vessel a breeches buoy suspended from a traveler block, or a life car, from rings running on the hawser.

Figure 3, below, represents the apparatus rigged, with the breeches buoy hauled off to the ship.

If the breeches buoy be sent, let one man immediately get into it, thrusting his legs through the breeches. If the life car, remove the hatch, place as many persons therein as it will hold (four to six) and secure the hatch on the outside by the hatch bar and hook, signal as before, and the buoy or car will be hauled ashore. This will be repeated until all are landed. On the last trip of the life car the hatch must be secured by the inside hatch bar.

In many instances two men can be landed in the breeches buoy at the same time by each putting a leg through a leg of the breeches and holding onto the lifts of the buoy.

Children, when brought ashore by the buoy, should be in the arms of older persons or securely lashed to the buoy. Women and children should be landed first.

In signaling as directed in the foregoing instructions, if in the daytime, let one man separate himself from the rest and swing his hat, a handkerchief, or his hand; if at night, the showing of a light and concealing it once or twice will be understood; and like signals will be made from the shore. (See, also, Signals on p. 264.)

Circumstances may arise, owing to the strength of the current or set, or the danger of the wreck breaking up immediately, when it would be impossible to send off the hawser. In such a case a breeches buoy or life car will be hauled

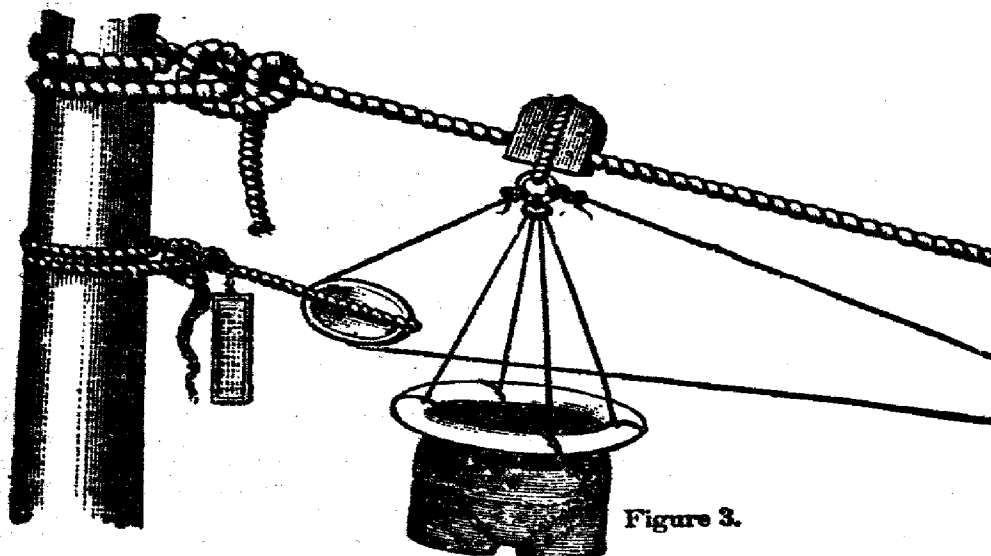


Figure 3.

off instead by the whip, or sent off to you by the shot-line, and you will be hauled ashore through the surf.

If your vessel is stranded during the night and discovered by the patrolman—which you will know by his burning a brilliant red light—keep a sharp lookout for signs of the arrival of the life-saving crew abreast of your vessel.

From one to four hours may intervene between the burning of the light and their arrival, as the patrolman may have to return to his station, perhaps 3 or 4 miles distant, and the life-saving crew draw the apparatus or surfboat through the sand or over bad roads to where your vessel is stranded.

Lights on the beach will indicate their arrival, and the sound of cannon firing from the shore may be taken as evidence that a line has been fired across your vessel. Therefore, upon hearing the cannon, make strict search aloft, fore and aft, for the shot-line, for it is almost certain to be there. Though the movements of the life-saving crew may not be perceptible to you, owing to the darkness, your vessel will be a good mark for the men experienced in the use of the wreck gun, and the first shot seldom fails.

IMPORTANT.

Remain by the wreck until assistance arrives from the shore, or as long as possible. If driven aloft, the inshore mast is the safest.

If not discovered immediately by the patrol, burn rockets, flare-up, or other lights, or, if the weather be foggy, fire guns or make other sound signals.

Make the shot-line fast on deck or to the rigging to prevent its being washed into the sea and possibly fouling the gear.

Take particular care that there are no turns of the whip line round the hawser before making the hawser fast.

Send the women, children, helpless persons, and passengers ashore first.

Make yourself thoroughly familiar with these instructions, and remember that on your coolness and strict attention to them will greatly depend the chances of success in bringing you and your people safely to land.

WRECK SIGNALS.

The following signals, approved by the International Marine Conference convened at Washington in October, 1889, have been adopted by the Coast Guard Service and will be used and recognized by the officers and employees as occasion may require:

"Upon the discovery of a wreck by night, the life-saving force will burn a red pyrotechnic light or a red rocket to signify—'*You are seen; assistance will be given as soon as possible.*'"

"A red flag waved on shore by day, or a red light, red rocket, or red Roman candle displayed by night, will signify—'*Haul away.*'"

"A white flag waved on shore by day, or a white light slowly swung back and forth, or a white rocket, or white Roman candle fired by night will signify—'*Slack away.*'"

"Two flags, a white and a red, waved at the same time on shore by day, or two lights, a white and a red, slowly swung at the same time, or a blue pyrotechnic light burned by night, will signify—'*Do not attempt to land in your own boats; it is impossible.*'"

"A man on shore beckoning by day, or two torches burning near together by night, will signify—'*This is the best place to land.*'"

"Any of these signals may be answered from the vessel as follows: In the daytime, waving a flag, a handkerchief, a hat, or even the hand, at night by firing a rocket, a blue light, or a gun, or by showing a light over the ship's gunwale for a short time, and then concealing it.

BOUNDARY LINES OF THE HIGH SEAS.

The following lines divide the high seas from rivers, harbors, and inland waters described in this volume. Waters inshore of the lines here laid down are "inland waters," and upon them the inland rules and pilot rules given on page 272 apply. Upon the high seas—viz waters outside of the lines here laid down—the international rules given on page 264 apply:

New York Harbor.—A line drawn from Rockaway Point Coast Guard Station $159\frac{1}{2}^{\circ}$ (S. by E.), $6\frac{1}{4}$ miles, to Ambrose Channel light vessel; thence $238\frac{1}{2}^{\circ}$ (WSW. $\frac{1}{2}$ W.), $8\frac{1}{4}$ miles, to Navesink (southerly) lighthouse.

Philadelphia Harbor and Delaware Bay.—A line drawn from Cape May lighthouse 200° (SSW. $\frac{1}{2}$ W.), $8\frac{1}{2}$ miles, to Overfalls light vessel; thence $246\frac{1}{4}^{\circ}$ (WSW. $\frac{1}{2}$ W.), $3\frac{1}{8}$ miles to Cape Henlopen lighthouse.

Baltimore Harbor and Chesapeake Bay.—A line drawn from Cape Charles lighthouse $179\frac{1}{2}^{\circ}$ (S. $\frac{1}{2}$ W.), $10\frac{1}{2}$ miles, to Cape Henry gas and whistling buoy, 2; thence 257° (W. $\frac{5}{8}$ S.), 5 miles, to Cape Henry lighthouse.

RULES OF THE ROAD—INTERNATIONAL RULES TO PREVENT COLLISIONS OF VESSELS.

[For inland rules of the road see p. 272.]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collisions at sea shall be followed by all public and private vessels of the United States upon the high seas and in all waters connected therewith navigable by seagoing vessels.

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

PRELIMINARY.

In the following rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The words "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

RULES CONCERNING LIGHTS AND SO FORTH.

The word "visible" in these rules when applied to lights shall mean visible on a dark night with a clear atmosphere.

ARTICLE 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

ART. 2. A steam vessel when under way shall carry—(a) On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel, at a height above the hull of not less than twenty feet, and if the breadth of the vessel exceeds twenty feet, then at a height above the hull not less than such breadth, so, however, that the light need not be carried at a greater height above the hull than forty feet, a bright white light, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(e) A steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

ART. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than six feet apart, and when towing more than one vessel shall carry an additional bright white light six feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a), excepting the additional light, which may be carried at a height of not less than fourteen feet above the hull.

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

ART. 4. (a) A vessel which from any accident is not under command shall carry at the same height as a white light mentioned in article two (a), where they can best be seen, and if a steam vessel in lieu of that light two red lights, in a vertical line one over the other, not less than six feet apart, and of such a character as to be visible all around the horizon at a distance of at least two miles; and shall by day carry in a vertical line one over the other, not less than six feet apart, where they can best be seen, two black balls or shapes, each two feet in diameter.

(b) A vessel employed in laying or in picking up a telegraph cable shall carry in the same position as the white light mentioned in article two (a),

and if a steam vessel in lieu of that light three lights in a vertical line one over the other not less than six feet apart. The highest and lowest of these shall be red, and the middle light shall be white, and they shall be of such a character as to be visible all around the horizon at a distance of at least two miles. By day she shall carry in a vertical line, one over the other, not less than six feet apart, where they can best be seen, three shapes not less than two feet in diameter, of which the highest and lowest shall be globular in shape and red in color, and the middle one diamond in shape and white.

(c) The vessels referred to in this article, when not making way through the water, shall not carry the side lights, but when making way shall carry them.

(d) The lights and shapes required to be shown by this article are to be taken by other vessels as signals that the vessel showing them is not under command and can not therefore get out of the way.

These signals are not signals of vessels in distress and requiring assistance. Such signals are contained in article thirty-one.

ART. 5. A sailing vessel under way and any vessel being towed shall carry the same lights as are prescribed by article two for a steam vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

ART. 6. Whenever, as in the case of small vessels under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Steam vessels of less than forty, and vessels under oars or sails of less than twenty ton gross tonnage, respectively, and rowing boats, when under way, shall not be required to carry the lights mentioned in article two (a), (b), and (c), but if they do not carry them they shall be provided with the following lights:

First. Steam vessels of less than forty tons shall carry—

(a) In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than nine feet, a bright white light constructed and fixed as prescribed in article two (a), and of such a character as to be visible at a distance of at least two miles.

(b) Green and red side lights constructed and fixed as prescribed in article two (b) and (c), and of such a character as to be visible at a distance of at least one mile, or a combined lantern showing a green light and a red light from right ahead to two points abaft the beam on their respective sides. Such lanterns shall be carried not less than three feet below the white light.

Second. Small steamboats, such as are carried by seagoing vessels, may carry the white light at a less height than nine feet above the gunwale, but it shall be carried above the combined lantern mentioned in subdivision one (b).

Third. Vessels under oars or sails of less than twenty tons shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

Fourth. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

The vessels referred to in this article shall not be obliged to carry the lights prescribed by article four (a) and article eleven, last paragraph.

ART. 8. Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with green glass on the one side and red glass on the other, to be used as prescribed above.

Pilot vessels when not engaged on their station on pilotage duty shall carry lights similar to those of other vessels of their tonnage.

A steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of 8 feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights. When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

ART. 9. Fishing vessels and fishing boats, when under way and when not required by this article to carry or show the lights hereinafter specified, shall carry or show the lights prescribed for vessels of their tonnage under way.

(a) Open boats, by which is to be understood boats not protected from the entry of sea water by means of a continuous deck, when engaged in any fishing at night, with outlying tackle extending not more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light.

Open boats, when fishing at night, with outlying tackle extending more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light, and in addition, on approaching or being approached by other vessels, shall show a second white light at least three feet below the first light and at horizontal distance of at least five feet away from it in the direction in which the outlying tackle is attached.

(b) Vessels and boats, except open boats as defined in subdivision (a), when fishing with drift nets, shall, so long as the nets are wholly or partly in the water, carry two white lights where they can best be seen. Such lights shall be placed so that the vertical distance between them shall be not less than six feet and not more than fifteen feet, and so that the horizontal distance between them, measured in a line with the keel, shall be not less than five feet and not more than ten feet. The lower of these two lights shall be in the direction of the nets, and both of them shall be of such a character as to show all around the horizon, and to be visible at a distance of not less than three miles.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the net or gear) a white light, visible at a distance of not less than one sea mile, on the approach of or to other vessels.

(c) Vessels and boats, except open boats as defined in subdivision (a), when line fishing with their lines out and attached to or hauling their lines, and when not at anchor or stationary within the meaning of subdivision (h), shall carry the same lights as vessels fishing with drift nets. When shooting lines, or fishing with towing lines, they shall carry the lights prescribed for a steam or sailing vessel under way, respectively.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the lines) a white light, visible at a distance of not less than one sea mile on the approach of or to other vessels.

(d) Vessels when engaged in trawling, by which is meant the dragging of an apparatus along the bottom of the sea—

First. If steam vessels, shall carry in the same position as the white light mentioned in article two (a) a tricolored lantern so constructed and fixed as to

show a white light from right ahead to two points on each bow, and a green light and a red light over an arc of the horizon from two points on each bow to two points abaft the beam on the starboard and port sides, respectively; and not less than six nor more than twelve feet below the tricolored lantern a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon.

Second. If sailing vessels, shall carry a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon, and shall also, on the approach of or to other vessels, show where it can best be seen a white flare-up light or torch in sufficient time to prevent collision.

All lights mentioned in subdivision (d) first and second shall be visible at a distance of at least two miles.

(e) Oyster dredgers and other vessels fishing with dredge nets shall carry and show the same light as trawlers.

(f) Fishing vessels and fishing boats may at any time use a flare-up light in addition to the lights which they are by this article required to carry and show, and they may also use working lights.

(g) Every fishing vessel and every fishing boat under one hundred and fifty feet in length, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least one mile.

Every fishing vessel of one hundred and fifty feet in length or upward, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least one mile, and shall exhibit a second light as provided for vessels of such length by article eleven.

Should any such vessel, whether under one hundred and fifty feet in length or of one hundred and fifty feet in length or upward, be attached to a net or other fishing gear, she shall on the approach of other vessels show an additional white light at least three feet below the anchor light, and at a horizontal distance of at least five feet away from it in the direction of the net or gear.

(h) If a vessel or boat when fishing becomes stationary in consequence of her gear getting fast to a rock or other obstruction, she shall in daytime haul down the day signal required by subdivision (k); at night show the light or lights prescribed for a vessel at anchor, and during fog, mist, falling snow, or heavy rain storms make the signal prescribed for a vessel at anchor. (See subdivision (d) and the last paragraph of article fifteen.)

(i) In fog, mist, falling snow, or heavy rain storms drift-net vessels attached to their nets, and vessels when trawling, dredging, or fishing with any kind of drag net, and vessels line fishing with their lines out, shall, if of twenty tons gross tonnage or upward, respectively, at intervals of not more than one minute make a blast; if steam vessels, with the whistle or siren, and if sailing vessels, with the foghorn, each blast to be followed by ringing the bell. Fishing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals; but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

(k) All vessels or boats fishing with nets or lines or trawls, when under way, shall in daytime indicate their occupation to an approaching vessel by displaying a basket or other efficient signal where it can best be seen. If vessels or boats at anchor have their gear out, they shall, on the approach of other vessels, show the same signal on the side on which those vessels can pass.

The vessels required by this article to carry or show the lights hereinbefore specified shall not be obliged to carry the lights prescribed by article four (a) and the last paragraph of article eleven.

ART. 10. A vessel which is being overtaken by another shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

The white light required to be shown by this article may be fixed and carried in a lantern, but in such case the lantern shall be so constructed, fitted, and screened that it shall throw an unbroken light over an arc of the horizon of twelve points of the compass, namely, for six points from right aft on each side of the vessel, so as to be visible at a distance of at least one mile. Such light shall be carried as nearly as practicable on the same level as the side lights.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty

and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

A vessel aground in or near a fairway shall carry the above light or lights and the two red lights prescribed by article four (a).

ART. 12. Every vessel may, if necessary in order to attract attention in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by ship-owners, which have been authorized by their respective Governments and duly registered and published.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, shall carry in daytime, forward, where it can best be seen, one black ball or shape two feet in diameter.

SOUND SIGNALS FOR FOG, AND SO FORTH.

ART. 15. All signals prescribed by this article for vessels under way shall be given:

First. By "steam vessels" on the whistle or siren.

Second. By "sailing vessels" and "vessels towed" on the foghorn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds duration.

A steam vessel shall be provided with an efficient whistle or siren sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient foghorn, to be sounded by mechanical means, and also with an efficient bell. In all cases where the rules require a bell to be used a drum may be substituted on board Turkish vessels, or a gong where such articles are used on board small seagoing vessels. A sailing vessel of twenty tons gross tonnage or upward shall be provided with a similar foghorn and bell.

In a fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

(a) A steam vessel having way upon her shall sound, at intervals of not more than two minutes, a prolonged blast.

(b) A steam vessel under way, but stopped, and having no way upon her, shall sound, at intervals of not more than two minutes, two prolonged blasts, with an interval of about one second between.

(c) A sailing vessel under way shall sound at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession; and when with the wind abaft the beam three blasts in succession.

(d) A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(e) A vessel when towing, a vessel employed in laying or in picking up a telegraph cable, and a vessel under way, which is unable to get out of the way of an approaching vessel through being not under command, or unable to maneuver as required by the rules, shall, instead of the signals prescribed in subdivisions (a) and (c) of this article, at intervals of not more than two minutes, sound three blasts in succession, namely: One prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

Sailing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals, but, if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

SPEED OF SHIPS TO BE MODERATE IN FOG, AND SO FORTH.

ART. 16. Every vessel shall, in a fog, mist, falling snow, or heavy rain storms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel bearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

STEERING AND SAILING RULES.

PRELIMINARY—RISK OF COLLISION.

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

ART. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, namely:

(a) A vessel which is running free shall keep out of the way of a vessel which is close-hauled.

(b) A vessel which is close-hauled on the port tack shall keep out of the way of a vessel which is close-hauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

ART. 18. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This article also applies to cases where vessels are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two vessels is end on, or nearly end on to the other; in other words, to cases in which, by day, each vessel sees the mast of the other in a line, or nearly in a line, with her own; and by night, to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course; or by night, to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

ART. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

ART. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

ART. 21. Where, by any of these rules, one of two vessels is to keep out of the way, the other shall keep her course and speed.

Note.—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision can not be avoided by the action of the giving-way vessel alone, she also shall take action as will best aid to avert collision [See articles twenty-seven and twenty-nine.]

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

ART. 24. Notwithstanding anything contained in these rules every vessel overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam—that is, in such a position, with reference to

the vessel which she is overtaking that at night she would be unable to see either of that vessel's side lights—shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward of or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

ART. 27. In obeying and constructing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER.

ART. 28. The words "short blast" used in this article shall mean a blast of about one second's duration.

When vessels are in sight of one another, a steam vessel under way, in taking any course authorized or required by these rules, shall indicate that course by the following signals on her whistle or siren, namely:

One short blast to mean, "I am directing my course to starboard."

Two short blasts to mean, "I am directing my course to port."

Three short blasts to mean, "My engines are going at full speed astern."

NO VESSEL, UNDER ANY CIRCUMSTANCES, TO NEGLECT PROPER PRECAUTIONS.

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

RESERVATION OF RULES FOR HARBORS AND INLAND NAVIGATION.

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

DISTRESS SIGNALS.

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime: First. A gun or other explosive signal fired at intervals of about a minute.

Second. The international code signal of distress indicated by N. C.

Third. The distance signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.

Fourth. A continuous sounding with any fog-signal apparatus.

At night: First. A gun or other explosive signal fired at intervals of about a minute.

Second. Flames on the vessel (as from a burning tar barrel, oil barrel, and so forth).

Third. Rockets or shells throwing stars of any color or description, fired one at a time, at short intervals.

Fourth. A continuous sounding with any fog-signal apparatus.

RULES OF THE ROAD—INLAND RULES TO PREVENT COLLISION OF VESSELS.

[For international rules of the road see p. 264.]

AN ACT To adopt regulations for preventing collisions upon certain harbors, rivers, and inland waters of the United States.

Whereas the provisions of chapter eight hundred and two of the laws of eighteen hundred and ninety, and the amendments thereto, adopting regulations for preventing collisions at sea, apply to all waters of the United States connected with the high seas navigable by seagoing vessels, except so far as the navigation of any harbor, river, or inland waters is regulated by special rules duly made by local authority; and

Whereas it is desirable that the regulations relating to the navigation of all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, shall be stated in one act: Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collision shall be followed by all vessels navigating all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and are hereby declared special rules duly made by local authority:

PRELIMINARY.

In the following rules every steam-vessel which is under sail and not under steam is to be considered a sailing-vessel, and every vessel under steam, whether under sail or not, is to be considered a steam-vessel.

The word "steam-vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

RULES CONCERNING LIGHTS, AND SO FORTH.

The word "visible" in these rules, when applied to lights, shall mean visible on a dark night with a clear atmosphere.

ARTICLE 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

ART. 2.¹ A steam vessel when under way shall carry—(a) On or in front of the foremast, or, if a vessel without a foremast, then in the fore part of the vessel, a bright white light so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(e) A seagoing steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These

¹ Article 2 is amended by act of Congress approved June 9, 1910, effective on and after July 9, 1910, in rules for lights required to be carried by every vessel propelled by machinery and not more than 65 feet in length, except tugboats and towboats propelled by steam. (See p. 282.)

two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

(f) All steam vessels (except seagoing vessels and ferryboats), shall carry in addition to green and red lights required by article two (b), (c), and screens as required by article two (d), a central range of two white lights; the after light being carried at an elevation at least fifteen feet above the light at the head of the vessel. The headlight shall be so constructed as to show an unbroken light through twenty points of the compass, namely, from right ahead to two points abaft the beam on either side of the vessel, and the after light so as to show all around the horizon.

ART. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than three feet apart, and when towing more than one vessel shall carry an additional bright white light three feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a) or the after range light mentioned in article two (f).

Such steam vessel may carry a small white light abaft the funnel or after-mast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

ART. 5. A sailing vessel under way or being towed shall carry the same lights as are prescribed by article two for a steam vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

ART. 6. Whenever, as in the case of vessels of less than ten gross tons under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy, the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

ART. 8.² Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

² AN ACT Relating to lights on steam pilot vessels.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights.

When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

SEC. 2. That this act shall be construed as supplementary to article eight of the act approved June seventh, eighteen hundred and ninety seven, entitled "An act to adopt regulations for preventing collisions upon certain harbors, rivers, and inland waters of the United States," and to article eight of an act approved August nineteen, eighteen hundred and ninety, entitled "An act to adopt regulations for preventing collisions at sea."

SEC. 3. That this act shall take effect on June thirtieth, nineteen hundred.

Approved, February 19, 1900.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

Pilot vessels, when not engaged on their station on pilotage duty, shall carry lights similar to those of other vessels of their tonnage.

ART. 9. (a) Fishing vessels of less than ten gross tons, when under way and when not having their nets, trawls, dredges, or lines in the water, shall not be obliged to carry the colored side lights; but every such vessel shall, in lieu thereof, have ready at hand a lantern with a green glass on one side and a red glass on the other side, and on approaching to or being approached by another vessel such lantern shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

(b) All fishing vessels and fishing boats of ten gross tons or upward, when under way and when not having their nets, trawls, dredges, or lines in the water, shall carry and show the same lights as other vessels under way.

(c) All vessels, when trawling, dredging, or fishing with any kind of drag nets or lines, shall exhibit, from some part of the vessel where they can be best seen, two lights. One of these lights shall be red and the other shall be white. The red light shall be above the white light, and shall be at a vertical distance from it of not less than six feet and not more than twelve feet; and the horizontal distance between them, if any, shall not be more than ten feet. These two lights shall be of such a character and contained in lanterns of such construction as to be visible all round the horizon, the white light a distance of not less than three miles and a red light of not less than two miles.

(d) Rafts, or other water craft not herein provided for, navigating by hand power, horsepower, or by the current of the river, shall carry one or more good white lights, which shall be placed in such manner as shall be prescribed by the Board of Supervising Inspectors of Steam Vessels.

ART. 10. A vessel which is being overtaken by another, except a steam vessel with an after range light showing all around the horizon, shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upward in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light. The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

ART. 12. Every vessel may, if necessary, in order to attract attention, in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by ship-owners, which have been authorized by their respective Governments, and duly registered and published.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, may carry in daytime, forward, where it can best be seen, one black ball or shape two feet in diameter.

SOUND SIGNALS FOR FOG, AND SO FORTH.

ART. 15. All signals prescribed by this article for vessels under way shall be given:

1. By "steam vessels" on the whistle or siren.
2. By "sailing vessels" and "vessels towed" on the fog horn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds duration.

A steam vessel shall be provided with an efficient whistle or siren, sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient fog horn; also with an efficient bell. A sailing vessel of twenty tons gross tonnage or upward shall be provided with a similar fog horn and bell.

In fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

(a) A steam vessel under way shall sound, at intervals of not more than one minute, a prolonged blast.

(c) A sailing vessel under way shall sound, at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession, and when with the wind abaft the beam, three blasts in succession.

(d) A vessel when at anchor shall, at intervals, of not more than one minute, ring the bell rapidly for about five seconds.

(e) A steam vessel when towing, shall, instead of the signals prescribed in subdivision (a) of this article, at intervals of not more than one minute, sound three blasts in succession, namely, one prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

(f) All rafts or other water craft, not herein provided for, navigating by hand power, horsepower, or by the current of the river, shall sound a blast of the foghorn, or equivalent signal, at intervals of not more than one minute.

SPEED OF SHIPS TO BE MODERATE IN FOG, AND SO FORTH.

ART. 16. Every vessel shall, in a fog, mist, falling snow, or heavy rainstorms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

STEERING AND SAILING RULES.

PRELIMINARY—RISK OF COLLISION.

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

ART. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other as follows, namely:

(a) A vessel which is running free shall keep out of the way of a vessel which is close-hauled.

(b) A vessel which is close-hauled on the port tack shall keep out of the way of a vessel which is close-hauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

ART. 18. RULE I. When steam vessels are approaching each other head and head, that is, end on, or nearly so, it shall be the duty of each to pass on the port side of the other; and either vessel shall give, as a signal of her intention, one short and distinct blast of her whistle, which the other vessel shall answer promptly by a similar blast of her whistle, and thereupon such vessels shall pass on the port side of each other. But if the course of such vessels are so far on the starboard of each other as not to be considered as meeting head and head, either vessel shall immediately give two short and distinct blasts of her whistle, which the other vessel shall answer promptly by two similar blasts of her whistle, and they shall pass on the starboard side of each other.

The foregoing only applies to cases where vessels are meeting end on or nearly end on, in such a manner as to involve risk of collision; in other words, to cases in which, by day, each vessel sees the masts of the other in a line,

or nearly in a line, with her own, and by night to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course, or by night to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

RULE III. If, when steam vessels are approaching each other, either vessel fails to understand the course or intention of the other, from any cause, the vessel so in doubt shall immediately signify the same by giving several short and rapid blasts, not less than four, of the steam whistle.

RULE V. Whenever a steam vessel is nearing a short bend or curve in the channel, where, from the height of the banks or other cause, a steam vessel approaching from the opposite direction can not be seen for a distance of half a mile, such steam vessel, when she shall have arrived within half a mile of such curve or bend, shall give a signal by one long blast of the steam whistle, which signal shall be answered by a similar blast, given by any approaching steam vessel that may be within hearing. Should such a signal be so answered by a steam vessel upon the farther side of such bend, then the usual signals for meeting and passing shall immediately be given and answered; but, if the first alarm signal of such vessel be not answered, she is to consider the channel clear and govern herself accordingly.

When steam vessels are moved from their docks or berths, and other boats are liable to pass from any direction toward them, they shall give the same signal as in the case of vessels meeting at a bend, but immediately after clearing the berths so as to be fully in sight they shall be governed by the steering and sailing rules.

RULE VIII. When steam vessels are running in the same direction, and the vessel which is astern shall desire to pass on the right or starboard hand of the vessel ahead, she shall give one short blast of the steam whistle, as a signal of such desire, and if the vessel ahead answers with one blast, she shall put her helm to port; or if she shall desire to pass on the left or port side of the vessel ahead, she shall give two short blasts of the steam whistle as a signal of such desire, and if the vessel ahead answers with two blasts, shall put her helm to starboard; or if the vessel ahead does not think it safe for the vessel astern to attempt to pass at that point, she shall immediately signify the same by giving several short and rapid blasts of the steam whistle, not less than four, and under no circumstances shall the vessel astern attempt to pass the vessel ahead until such time as they have reached a point where it can be safely done, when said vessel ahead shall signify her willingness by blowing the proper signals. The vessel ahead shall in no case attempt to cross the bow or crowd upon the course of the passing vessel.

RULE IX. The whistle signals provided in the rules under this article, for steam vessels meeting, passing, or overtaking, are never to be used except when steamers are in sight of each other, and the course and position of each can be determined in the daytime by a sight of the vessel itself, or by night by seeing its signal lights. In fog, mist, falling snow or heavy rainstorms, when vessels can not so see each other, fog signals only must be given.

ART. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

ART. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

ART. 21. Where, by any of these rules, one of the two vessels is to keep out of the way, the other shall keep her course and speed.

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel. Every vessel coming up with another vessel from any direction more than two points abaft her beam; that is, in such position, with reference to the vessel which

she is overtaking that at night she would be unable to see either of that vessel's side lights, shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

ART. 27. In obeying and construing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER.

ART. 28. When vessels are in sight of one another a steam vessel under way whose engines are going at full speed astern shall indicate that fact by three short blasts on the whistle.

NO VESSEL UNDER ANY CIRCUMSTANCES TO NEGLECT PROPER PRECAUTIONS.

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

ART. 30. The exhibition of any light on board of a vessel of war of the United States or a revenue cutter may be suspended whenever, in the opinion of the Secretary of the Navy, the commander in chief of a squadron, or the commander of a vessel acting singly, the special character of the service may require it.

DISTRESS SIGNALS.

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore, the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime: A continuous sounding with any fog-signal apparatus, or firing a gun.

At night: First. Flames on the vessel as from a burning tar barrel, oil barrel, and so forth.

Second. A continuous sounding with any fog-signal apparatus, or firing a gun.

RULES FOR LIGHTS FOR CERTAIN CLASSES OF VESSELS NAVIGATING THE HARBORS, RIVERS, AND INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES.

The following rules for lights to be carried by ferryboats, rules for lights for barges and canal boats in tow of steam vessels, rules for lights for rafts and other water craft navigating by hand power, horsepower, or by the current of the river, rule relating to use of searchlights, rule prohibiting unnecessary sounding of the steam whistle, rule prohibiting the carrying of unauthorized lights on steam vessels, and rule relating to drawbridges over navigable waters of the United States were adopted by the Board of Supervising Inspectors, Steamboat Inspection Service, and approved by the Secretary of Commerce.

These rules concerning lights shall be complied with in all weathers from sunset to sunrise.

RULES FOR LIGHTS TO BE CARRIED BY FERRYBOATS NAVIGATING THE HARBORS, RIVERS, AND INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES.³

Ferryboats propelled by machinery and navigating the harbors, rivers, and other inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, shall carry the range lights and the colored side lights required by law to be carried on steam vessels navigating those waters, except that *double-end ferryboats* shall carry a central range of clear, bright, white lights, showing all around the horizon, placed at equal altitudes forward and aft, also on the starboard side a green light, and on the port side a red light, of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of 10 points of the compass, and so fixed as to throw the light from right ahead to 2 points abaft the beam on their respective sides.

The green and red lights shall be fitted with inboard screens projecting at least 3 feet forward from the lights, so as to prevent them from being seen across the bow.

Local inspectors in districts having ferryboats shall, whenever the safety of navigation may require, designate for each line of such boats a certain light, white or colored, which shall show all around the horizon, to designate and distinguish such lines from each other, which light shall be carried on a flagstaff amidships, 15 feet above the white range lights.

RULES FOR LIGHTS FOR BARGES AND CANAL BOATS IN TOW OF STEAM VESSELS AND FOR LIGHTS AND DAY SIGNALS FOR DREDGES, VESSELS WORKING ON WRECKS, ETC., NAVIGATING THE HARBORS, RIVERS, AND OTHER INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES.

LIGHTS FOR BARGES AND CANAL BOATS IN THE TOW OF STEAM VESSELS ON CERTAIN INLAND WATERS ON THE SEABOARD, EXCEPT THE HUDSON RIVER AND ADJACENT WATERS AND LAKE CHAMPLAIN.

On the harbors, rivers, and other inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and except on the waters of the Hudson River and its tributaries from Troy to the boundary lines of New York Harbor off Sandy Hook, as defined pursuant to section 2 of the act of Congress of February 19, 1895, the East River, and Long Island Sound (and the waters entering thereon, and to the Atlantic Ocean), to and including Narragansett Bay, R. I., and tributaries, and Lake Champlain, barges (except scows) and canal boats in tow of steam vessels shall carry lights as follows:

Barges and canal boats towing astern of steam vessels, when towing singly, or what is known as tandem towing, shall each carry a green light on the starboard side and a red light on the port side, and a white light on the stern, except that the last vessel of such tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon.

When two or more boats are abreast, the colored lights shall be carried at the outer sides of the bows of the outside boats. Each of the outside boats in last tier of hawser tow shall carry a white light on her stern.

The white light required to be carried on stern of a barge or canal boat carrying red and green side lights shall be carried in a lantern so constructed

³ See act of Congress approved June 9, 1910, effective on and after July 9, 1910, prescribing lights that shall be carried by certain classes of vessels of not more than 35 feet in length, amendatory of these rules, p. 282.

that it shall show an unbroken light over an arc of the horizon of 12 points of the compass, namely, for 6 points from right aft on each side of the vessel, and shall be of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles.

Barges or canal boats towing alongside a steam vessel shall, if the deck, deck houses, or cargo of the barge or canal boat be so high above water as to obscure the side lights of the towing steamer when being towed on the starboard side of the steamer, carry a green light upon the starboard side; and when towed on the port side of the steamer, a red light on the port side of the barge or canal boat; and if there is more than one barge or canal boat abreast, the colored lights shall be displayed from the outer side of the outside barges or canal boats.

The colored side lights referred to in these rules for barges and canal boats in tow shall be fitted with inboard screens, so as to prevent them from being seen across the bow, and of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least 2 miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of 10 points of the compass, and so fixed as to throw the light from right ahead to 2 points abaft the beam on either side. The minimum size of glass globes shall not be less than 6 inches in diameter and 5 inches high in the clear.

Scows when being towed by steam vessels on the waters covered by the first paragraph of these rules shall carry a white light at each end of each scow, except that when such scows are massed in tiers, two or more abreast, each of the outside scows shall carry a white light on its outer bow, and the outside scows in the last tier shall each carry, in addition, a white light on the outer part of the stern. The white light shall be carried not less than 8 feet above the surface of the water, and shall be so placed as to show an unbroken light all around the horizon, and shall be of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 5 miles.

LIGHTS FOR BARGES AND CANAL BOATS IN TOW OF STEAM VESSELS ON THE HUDSON RIVER AND ADJACENT WATERS AND LAKE CHAMPLAIN.

All nondescript vessels known as scows, car floats, lighters, and vessels of similar type, navigating the waters referred to in the following rules, shall carry the lights required to be carried by barges and canal boats in tow of steam vessels, as prescribed in such rules.

Barges and canal boats, when being towed by steam vessels on the waters of the Hudson River and its tributaries from Troy to the boundary lines of New York Harbor off Sandy Hook, as defined pursuant to section 2 of the act of Congress of February 19, 1895, the East River, and Long Island Sound (and the waters entering thereon, and to the Atlantic Ocean), to and including Narragansett Bay, R. I., and tributaries, and Lake Champlain, shall carry lights as follows:

Barges and canal boats being towed astern of steam vessels, when towing singly or what is known as tandem towing, shall each carry a white light on the bow and a white light on the stern, except that the last vessel of such tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon: *Provided*, That seagoing barges shall not be required to make any change in their seagoing lights (red and green) on waters coming within the scope of these rules, except that the last vessel of the tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon.

Barges and canal boats, when towed at a hawser two or more abreast, when in one tier, shall carry a white light on the bow and a white light on the stern of each of the outside boats; when in more than one tier, each of the outside boats shall carry a white light on its bow; and the outside boats in the last tier shall each carry, in addition, a white light on the outer afterpart of the stern.

Barges or canal boats towed alongside a steam vessel, if on the starboard side of said steam vessel, shall display a white light on her own starboard bow; and if on the port side of said steam vessel shall display a white light on her own port bow; and if there is more than one barge or canal boat alongside, the white lights shall be displayed from the outboard side of the outside barge or canal boat: *Provided*, That barges known as car floats when towed alongside shall have a white light at each outboard corner of said barge.

When barges or canal boats are massed in tiers and towed at a hawser, as is usual on the Hudson River, there shall be carried on the forward port side of the port boat of each tier a white light, and on the forward starboard side of the starboard boat in each tier a white light, and on the after port side of the port boat in the stern tier a white light, and on the after starboard side of the starboard boat in the stern tier a white light.

The white bow lights for barges and canal boats referred to in the preceding rules shall be carried at least 10 feet and not more than 30 feet abaft the stem or extreme forward end of the vessel. On barges and canal boats required to carry a white bow light, the white light on bow and the white light on stern shall each be so placed above the hull or deck house as to show an unbroken light all around the horizon, and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 5 miles: *Provided*, That nothing in these rules shall be construed as compelling barges or canal boats in tow of steam vessels, passing through any waters coming within the scope of these rules where lights for barges or canal boats are different from those of the waters whereon such vessels are usually employed, to change their lights from those required on the waters from which their trip begins or terminates; but should such vessels engage in local employment on waters requiring different lights from those where they are customarily employed they shall comply with the local rules where employed.

RULES FOR LIGHTS AND DAY SIGNALS TO BE CARRIED BY VESSELS, DREDGES OF ALL TYPES, AND VESSELS WORKING ON WRECKS OR OTHER OBSTRUCTIONS TO NAVIGATION, OR MOORED FOR SUBMARINE OPERATIONS OR MADE FAST TO A SUNKEN OBJECT WHICH MAY DRIFT WITH THE TIDE OR BE TOWED.⁴

RULE 1.—RULE FOR SIGNALS TO BE DISPLAYED BY A TOWING VESSEL WHEN TOWING A SUBMERGED OR PARTLY SUBMERGED OBJECT UPON A HAWSER WHEN NO SIGNALS ARE DISPLAYED UPON THE OBJECT WHICH IS TOWED.

The vessel having the submerged object in tow shall display by day, where they can best be seen, two shapes, one above the other, not less than 6 feet apart, the lower shape to be carried not less than 10 feet above the deck houses. The shapes shall be in the form of a double frustum of a cone, base to base, not less than 2 feet in diameter at the center nor less than 8 inches at the ends of the cones, and to be not less than 4 feet lengthwise from end to end, the upper shape to be painted in alternate horizontal stripes of black and white, 8 inches in width, and the lower shape to be painted a solid bright red.

By night the towing vessel shall display the regular side lights, but in lieu of the regular white towing lights shall display four lights in a vertical position not less than 3 feet nor more than 6 feet apart, the upper and lower of such lights to be white, and the two middle lights to be red, all of such lights to be of the same character as is now prescribed for the regular towing lights.

RULE 2.—RULE FOR STEAMERS, DERRICK BOATS, LIGHTERS, OR OTHER TYPES OF VESSELS MADE FAST ALONGSIDE A WRECK, OR MOORED OVER A WRECK WHICH IS ON THE BOTTOM OR PARTLY SUBMERGED, OR WHICH MAY BE DRIFTING.

Steamers, derrick boats, lighters, or other types of vessels made fast alongside a wreck, or moored over a wreck which is on the bottom or partly submerged, or which may be drifting, shall display by day two shapes of the same character and dimensions and displayed in the same manner as required by the foregoing rule, except that both the shapes shall be painted a solid bright red, but where more than one vessel is working under the above conditions, the shapes need be displayed only from one vessel on each side of the wreck from which it can best be seen from all directions.

By night this situation shall be indicated by the display of a white light from the bow and stern of each outside vessel or lighter not less than 6 feet above the deck, and in addition thereto there shall be displayed in a position where they may best be seen from all directions two red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart, and not less than 15 feet above the deck.

⁴Adopted by executive committee of Board of Supervising Inspection on July 22, 1914, and approved by Secretary of Commerce on July 28, 1914. Adopted by Board of Supervising Inspectors on January 20, 1915, and approved by the Secretary of Commerce on April 12, 1915.

RULE 3.—RULE FOR DREDGES WHICH ARE HELD IN STATIONARY POSITION BY MOORINGS OR SPUDS.

Dredges which are held in stationary position by moorings or spuds shall display by day two red balls not less than 2 feet in diameter and carried in a vertical line not less than 3 feet nor more than 6 feet apart, and at least 15 feet above the deck house and in such a position where they can best be seen from all directions.

By night they shall display a white light at each corner, not less than 6 feet above the deck, and in addition thereto there shall be displayed in a position where they may best be seen from all directions two red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart, and not less than 15 feet above the deck. When scows are moored alongside a dredge in the foregoing situation they shall display a white light on each outboard corner, not less than 6 feet above the deck.

RULE 4.—RULE FOR SELF-PROPELLING SUCTION DREDGES UNDER WAY WITH THEIR SUCTIONS ON THE BOTTOM.

Self-propelling suction dredges under way with their suction on the bottom shall display by day the same signals as are used to designate any steamer not under control; that is to say, two black balls not less than 2 feet in diameter and carried not less than 15 feet above the deck house, and where they may best be seen from all directions.

By night they shall carry, in addition to the regular running lights, two red lights of the same character as the masthead light, in the same vertical plane and underneath the masthead light, the red lights to be not less than 3 feet nor more than 6 feet apart and the upper red light to be not less than 4 feet and not more than 6 feet below the white masthead light, and on or near the stern two red lights in the same vertical plane not less than 4 feet nor more than 6 feet apart, to show through 4 points of the compass; that is, from right astern to 2 points on each quarter.

RULE 5.—RULE FOR VESSELS WHICH ARE MOORED OR ANCHORED AND ENGAGED IN LAYING PIPE OR OPERATING ON SUBMARINE CONSTRUCTION OR EXCAVATION.

Vessels which are moored or anchored and engaged in laying pipe or operating on submarine construction or excavation shall display by day, not less than 15 feet above the deck, where they can best be seen from all directions, two balls not less than 2 feet in diameter, in a vertical line not less than 3 feet and not more than 6 feet apart, the upper ball to be painted in alternate black and white vertical stripes 6 inches wide, and the lower ball to be painted a solid bright red.

By night they shall display three red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart and not less than 15 feet above the deck, and in such position as may best be seen from all directions. All the lights required by these special rules for dredges, wrecking boats, lighters, etc., shall be of such size and character as to be visible on a dark night with a clear atmosphere for a distance of at least 2 miles.

RULE 6.—RULE FOR VESSELS WHICH ARE MOORED OR AT ANCHOR.

Vessels of more than 300 gross tons propelled by machinery when moored or anchored in a fairway or channel where traffic is liable to congestion or confusion shall display between sunrise and sunset on the forward part of the vessel where it can best be observed from other vessels one black ball or shape not less than 2 feet in diameter.

RULE PROHIBITING THE CARRYING OF UNAUTHORIZED LIGHTS ON STEAM VESSELS.

Any master or pilot of any steam vessel who shall authorize or permit the carrying of any light, electric or otherwise, not required by law, on the outside structure of the cabin or hull of the vessel that in any way will interfere with distinguishing the signal lights shall, upon conviction thereof before any board of inspectors having jurisdiction, be deemed guilty of misconduct and shall be liable to have his license suspended or revoked.

AN ACT To amend laws for preventing collisions of vessels and to regulate equipment of certain motor boats on the navigable waters of the United States.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the words "motor boat" where used in this act shall include every vessel propelled by machinery and not more than sixty-five feet in length except tug boats and tow boats propelled by steam. The length shall be measured from end to end over the deck, excluding sheer: *Provided*, That the engine, boiler, or other operating machinery shall be subject to inspection by the local inspectors of steam vessels, and to their approval of the design thereof, on all said motor boats, which are more than forty feet in length, and which are propelled by machinery driven by steam.

SEC. 2. That motor boats subject to the provisions of this Act shall be divided into classes as follows:

Class one. Less than twenty-six feet in length.

Class two. Twenty-six feet or over and less than forty feet in length.

Class three. Forty feet or over and not more than sixty-five feet in length.

SEC. 3. That every motor boat in all weathers from sunset to sunrise shall carry the following lights, and during such time no other lights which may be mistaken for those prescribed shall be exhibited.

(a) Every motor boat of class one shall carry the following lights:

First. A white light aft to show all around the horizon.

Second. A combined lantern in the fore part of the vessel and lower than the white light aft showing green to starboard and red to port, so fixed as to throw the light from right ahead to two points abaft the beam on their respective sides.

(b) Every motor boat of classes two and three shall carry the following lights:

First. A bright white light in the fore part of the vessel as near the stem as practicable, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side. The glass or lens shall be of not less than the following dimensions:

Class two. Nineteen square inches.

Class three. Thirty-one square inches.

Second. A white light aft to show all around the horizon.

Third. On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side. On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side. The glasses or lenses in the said side lights shall be of not less than the following dimensions on motor boats of—

Class two. Sixteen square inches.

Class three. Twenty-five square inches.

On and after July first, nineteen hundred and eleven, all glasses or lenses prescribed by paragraph (b) of section three shall be fresnel or fluted. The said lights shall be fitted with inboard screens of sufficient height and so set as to prevent these lights from being seen across the bow and shall be of not less than the following dimensions on motor boats of—

Class two. Eighteen inches long.

Class three. Twenty-four inches long: *Provided*, That motor boats as defined in this act, when propelled by sail and machinery or under sail alone, shall carry the colored lights suitably screened but not the white lights prescribed by this section.

SEC. 3. (a) Every motor boat under the provisions of this act shall be provided with a whistle or other sound-producing mechanical appliance capable of producing a blast of two seconds or more in duration, and in the case of such boats so provided a blast of at least two seconds shall be deemed a prolonged blast within the meaning of the law.

(b) Every motor boat of class two or three shall carry an efficient foghorn.

(c) Every motor boat of class two or three shall be provided with an efficient bell, which shall be not less than eight inches across the mouth on board of vessels of class three.

SEC. 5. That every motor boat subject to any of the provisions of this act, and also all vessels propelled by machinery other than by steam more than sixty-five feet in length, shall carry either life preservers or life belts, or buoyant cushions, or ring buoys or other device, to be prescribed by the Secretary of Commerce, sufficient to sustain afloat every person on board and so placed as to be readily accessible. All motor boats carrying passengers for hire shall carry one life preserver of the sort prescribed by the regulations of the Board of Supervising Inspectors for every passenger carried, and no such boat while so carrying passengers for hire shall be operated or navigated except in charge of a person duly licensed for such service by the local board of inspectors. No examination shall be required as the condition of obtaining such a license, and any such license shall be revoked or suspended by the local board of inspectors for misconduct, gross negligence, recklessness in navigation, intemperance, or violation of law on the part of the holder, and if revoked the person holding such license shall be incapable of obtaining another such license for one year from the date of revocation: *Provided*, That motor boats shall not be required to carry licensed officers, except as required in this act.

SEC. 6. That every motor boat and also every vessel propelled by machinery other than by steam, more than sixty-five feet in length, shall carry ready for immediate use the means of promptly and effectually extinguishing burning gasoline.

SEC. 7. That a fine not exceeding one hundred dollars may be imposed for any violation of this act. The motor boat shall be liable for the said penalty and may be seized and proceeded against, by way of libel, in the district court of the United States for any district within which such vessel may be found.

SEC. 8. That the Secretary of Commerce shall make such regulations as may be necessary to secure the proper execution of this act by collectors of customs and other officers of the Government. And the Secretary of the Department of Commerce may, upon application therefor, remit or mitigate any fine, penalty, or forfeiture relating to motor boats except for failure to observe the provisions of section six of this act.

SEC. 9. That all laws and parts of laws only in so far as they are in conflict herewith are hereby repealed: *Provided*, That nothing in this act shall be deemed to alter or amend acts of Congress embodying or revising international rules for preventing collisions at sea.

SEC. 10. That this act shall take effect on and after thirty days after its approval.

RULES FOR LIGHTS FOR RAFTS AND OTHER WATER CRAFT NAVIGATING BY HAND POWER, HORSEPOWER, OR BY THE CURRENT OF THE RIVER, ON THE HARBORS, RIVERS, AND OTHER INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES.

Any vessel, except rafts and rowing boats under oars, navigating by *hand power, horsepower, or by the current of the river*, shall carry one white light forward, not less than 8 feet above the surface of the water.

Rafts propelled by hand power or by the current of the river, or which shall be anchored or moored in or near a channel or fairway, shall carry white lights, as follows: Rafts of one crib and not more than two in length shall carry one white light. Rafts of three or more cribs in length and one crib in width shall carry one white light at each end of the raft. Rafts of more than one crib abreast shall carry one white light on each outside corner of the raft, making four lights in all.

The *white light* required by these rules for rafts and other water craft shall be carried, from sunset to sunrise, in a lantern so fixed and constructed as to show a clear, uniform, and unbroken light, visible all around the horizon, and of such intensity as to be visible on a dark night with a clear atmosphere at a distance of at least 1 mile. The lights for rafts shall be suspended from poles of such height that the lights shall not be less than 8 feet above the surface of the water.

Meteorological tables compiled by the United States Weather Bureau.

NEW YORK, N. Y.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in ° F.								Precipitation (inches).				Wind.										Number of days dense fog.				
	Mean.	Extremes.		For month.	Mean.			Extremes.			Average relative humidity.	Average amount of clouds 0-10.	Precipitation (inches).			Statute miles.	Average number of times (observations at 8 a. m. and 8 p. m.) from—								Number of days with winds of 40 miles or over.						
		Highest.	Lowest.		Range.	Mean maximum.	Mean minimum.	Range.	Highest.	Lowest.			Range.	Average fall.	Number of days 0.01 inch or more.		Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.		SW.		W.	NW.	Calm.	
January.....	30.10	30.97	28.61	2.36	30.9	37.4	24.5	12.9	67	73	72	6	9	3.79	12	2.48	20	86	4	7	4	3	5	4	3	8	14	16	1	12	3
February.....	30.08	31.00	28.70	2.30	31.3	38.4	24.2	14.2	69	76	72	6	9	3.74	10	3.25	20	96	5	5	4	2	4	4	6	13	17	0	10	3	
March.....	30.00	30.95	28.38	2.57	37.7	45.4	30.2	15.2	80	77	68	6	9	4.10	12	3.60	21	92	4	4	7	7	4	6	6	10	17	0	14	3	
April.....	30.00	30.68	29.14	1.54	49.4	57.2	41.6	15.6	91	77	68	6	6	3.30	11	3.72	18	84	4	8	7	7	5	7	5	9	16	0	10	2	
May.....	29.99	30.52	29.13	1.39	60.6	68.5	52.6	15.9	95	81	72	6	6	3.18	11	4.17	16	90	3	6	10	7	7	9	9	7	11	0	6	2	
June.....	29.98	30.56	29.34	1.22	68.8	77.0	60.5	16.5	97	84	72	6	6	3.26	10	3.88	14	75	4	7	5	6	6	10	8	8	9	3	5	1	
July.....	29.98	30.51	29.46	1.05	73.8	81.7	65.9	15.8	99	86	72	6	6	4.54	12	3.80	14	88	4	5	7	5	5	12	11	10	12	0	3	1	
August.....	30.00	30.44	29.28	1.16	73.1	80.1	68.2	13.9	102	88	74	6	6	4.53	10	5.05	13	76	4	8	7	6	6	10	8	7	10	0	3	1	
September.....	30.06	30.61	29.19	1.42	66.8	73.7	59.8	13.9	100	86	74	6	6	3.59	9	6.17	14	80	5	8	8	6	6	10	8	6	10	0	3	1	
October.....	30.06	30.66	29.15	1.51	56.3	63.7	49.0	14.7	88	74	72	6	6	3.71	9	9.40	16	76	6	8	4	6	6	6	7	12	13	0	6	2	
November.....	30.09	30.80	28.70	2.10	44.2	51.0	37.3	13.7	74	67	71	6	6	3.44	9	3.62	19	76	4	4	5	3	1	5	6	17	19	0	10	2	
December.....	30.09	30.93	28.97	1.96	35.0	41.2	28.8	12.4	68	81	72	6	6	3.45	10	2.93	19	90	4	6	6	3	2	5	9	15	18	0	11	3	
Mean.....	30.04				52.3	59.6	45.0	14.6			71	6					17		51	79	65	53	91		91	128	168	4	95	23	
Total.....														44.63	125																

¹ Less than 1.

Meteorological tables compiled by the United States Weather Bureau—Continued.

ATLANTIC CITY, N. J.

Month.	Barometer at 32° F. and mean sea level.			Air temperature, in °F.						Precipitation (inches).		Wind.		Number of days dense fog.																
	Mean.	Extremes.		For month.	Mean.			Range.	Average relative humidity.	Average amount of clouds 0-10.	Average number of times (observations at 8 a. m. and 8 p. m.) from—		Number of days with winds of 40 miles or over.	Number of days dense fog.																
		Highest.	Lowest.		Range.	Mean maximum.	Mean minimum.				Range.	N.			NW.															
																Highest.	Lowest.	Range.												
January.....	30.11	30.94	28.80	2.14	32.5	39.4	25.7	13.7	68	4	72	78	76	79	6	3.40	12	2.98	9	6	3	3	4	13	9	15	0	1	2	
February.....	30.11	30.97	28.79	2.18	33.6	40.6	28.5	14.1	71	7	78	76	78	76	11	58	11	2.66	8	5	2	2	4	8	10	17	0	1	1	
March.....	30.02	30.93	28.76	2.17	38.6	45.2	32.0	13.2	79	8	71	78	76	78	11	68	11	2.63	7	8	4	4	4	8	12	5	14	0	1	2
April.....	30.00	30.67	29.14	1.53	47.8	54.4	41.3	13.1	85	19	66	77	76	77	11	56	11	3.15	6	7	3	5	8	14	5	12	0	1	2	
May.....	29.98	30.56	29.34	1.22	58.1	64.8	51.5	13.3	95	33	62	80	82	82	11	56	10	3.06	5	9	5	5	8	15	6	9	0	1	3	
June.....	29.98	30.51	29.40	1.11	66.6	72.7	60.4	12.3	97	45	52	82	80	82	10	52	9	2.93	5	8	4	6	9	17	6	5	0	1	2	
July.....	29.98	30.50	29.55	0.95	72.1	78.0	66.3	11.7	99	52	47	82	82	82	10	50	8	3.41	8	7	4	4	10	22	5	5	0	1	1	
August.....	30.00	30.45	29.48	0.97	72.5	78.4	66.6	11.8	104	48	56	82	80	82	10	60	6	3.41	8	6	5	5	10	16	5	6	0	1	1	
September.....	30.07	30.60	29.19	1.41	66.8	72.9	60.7	12.2	94	37	57	80	78	78	9	60	9	3.88	9	7	5	4	6	11	6	7	0	1	2	
October.....	30.07	30.81	29.06	1.75	56.9	63.7	50.2	13.5	90	29	61	78	76	76	9	60	11	9.21	10	7	5	4	6	9	8	12	0	1	1	
November.....	30.10	30.84	28.74	2.10	45.6	52.7	38.5	14.2	77	10	67	76	76	76	9	63	7	3.70	10	3	3	3	3	9	14	18	0	1	1	
December.....	30.10	30.90	28.54	2.36	36.4	43.1	29.6	13.5	68	7	75	78	78	78	10	64	8	3.52	10	2	2	2	4	8	14	19	0	1	2	
Mean.....	30.04				52.3	58.8	45.8	13.1																						
Total.....																														

! Less than 1.

Meteorological tables compiled by the United States Weather Bureau—Continued.
PHILADELPHIA, PA.

Month.	Barometer at 32° F. and mean sea level.			Air temperature, in ° F.										Precipitation (inches).				Wind.										Number of days dense fog.
	Mean.	Extremes.		For month.	Mean.			Extremes.			Average amount of clouds 0-10.	Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Statute miles.	Average number of times (observations at 8 a. m. and 8 p. m.) from—								Number of days with winds of 40 miles or over.			
		Highest.	Lowest.		Range.	Mean maximum.	Mean minimum.	Range.	Highest.	Lowest.							Range.	N.	NE.	E.	SE.	S.	SW.	W.		NW.	Calm.	
January.....	30.71	30.97	28.67	2.30	32.6	25.7	13.7	72	-5	77	73	3.41	12	3.33	11	60	8	7	3	6	7	11	6	16	0	1	2	
February.....	30.10	30.90	28.01	1.98	33.9	26.8	14.1	75	-6	81	71	3.38	11	3.86	12	48	7	9	2	2	4	4	9	7	18	0	1	
March.....	30.02	30.92	28.80	2.12	40.8	33.0	15.6	86	5	81	69	3.45	12	2.79	12	60	9	8	4	4	7	7	8	5	14	0	1	
April.....	30.01	30.69	29.19	1.50	52.1	43.2	17.7	93	18	75	64	2.91	11	2.77	11	50	9	9	4	4	8	8	8	6	13	0	1	
May.....	29.99	30.56	29.36	1.20	62.9	53.9	18.1	96	35	61	63	3.20	11	3.16	10	60	7	7	5	5	6	8	10	6	11	0	1	
June.....	29.98	30.54	29.38	1.16	71.4	62.6	17.6	98	46	52	69	3.30	10	3.43	9	54	6	6	5	4	9	9	10	6	9	0	1	
July.....	29.98	30.51	29.54	0.97	76.2	67.9	16.6	103	54	49	69	4.33	11	3.00	9	53	6	5	4	9	9	10	4	7	0	1	1	
August.....	30.00	30.45	29.42	1.03	84.5	67.0	15.6	106	51	55	72	4.61	11	5.89	8	55	8	8	5	5	9	10	4	7	0	1	1	
September.....	30.08	30.61	29.32	1.29	68.0	59.9	16.1	102	40	62	74	3.38	9	5.62	9	58	10	8	4	4	9	7	10	5	9	0	1	
October.....	30.07	30.66	29.10	1.56	57.8	49.8	15.9	91	31	60	71	3.10	9	3.70	10	75	8	9	4	4	7	6	9	5	15	0	2	
November.....	30.10	30.84	28.88	1.96	45.7	38.8	13.7	77	8	69	71	3.08	9	2.59	10	60	6	5	5	2	3	6	12	9	16	0	2	
December.....	30.11	30.93	29.03	1.90	36.3	29.8	13.1	70	-5	75	71	3.94	10	3.78	11	63	6	6	7	2	3	6	11	8	18	0	2	
Mean.....	30.05				54.4	40.5	15.7				70	41.17	126		10		90	81	44	78	86	122	72	157	0	2	12	
Total.....																												

¹ Less than 1.

Meteorological tables compiled by the United States Weather Bureau—Continued.

BALTIMORE, MD.

Month.	Barometer at 32° F. and mean sea level.			Air temperature, in °F.								Precipitation (inches).			Wind.										Number of days dense fog.
	Mean.	Extremes.		Mean.				Extremes.				Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Statute miles.	Average number of times (observations at 8 a. m. and 8 p. m.) from—								Number of days with winds of 40 miles or over.	
		Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	For month.	Mean maximum.	Mean minimum.	Range.					N.	NE.	E.	SE.	S.	SW.	W.	NW.		
January.....	30.12	30.98	28.80	2.18	33.8	40.6	27.0	13.6	74	-6	80	3.27	6	48	10	6	4	6	8	10	6	11	1	10	3
February.....	30.11	30.94	28.96	1.98	35.4	42.5	28.3	14.2	78	-7	85	3.51	7	45	10	5	3	4	5	10	5	14	0	10	2
March.....	30.03	30.92	29.09	1.83	42.3	50.2	34.5	15.7	88	5	93	3.88	8	50	8	5	5	5	10	9	5	11	1	10	2
April.....	30.01	30.71	29.10	1.61	53.6	62.4	44.8	17.6	94	23	71	3.27	7	60	9	6	5	6	10	7	5	12	0	10	1
May.....	29.99	30.56	29.36	1.20	64.4	73.3	55.5	17.8	96	34	62	3.56	7	43	8	6	6	6	10	10	5	10	0	10	1
June.....	29.99	30.50	29.38	1.12	72.7	81.3	64.0	17.3	100	46	54	3.84	6	42	8	7	5	5	11	12	4	8	0	10	10
July.....	29.98	30.51	29.58	0.93	77.2	85.6	68.8	16.8	104	55	49	4.02	6	70	8	7	4	3	14	13	4	4	0	10	10
August.....	30.01	30.45	29.44	1.01	75.5	83.5	67.5	16.0	105	51	54	4.21	6	45	10	9	6	5	13	11	4	4	0	10	1
September.....	30.08	30.62	29.27	1.35	68.5	76.7	60.2	16.5	101	39	62	6.07	6	40	11	9	7	3	11	7	3	8	1	10	1
October.....	30.08	30.84	28.83	2.01	58.2	66.5	49.8	16.7	92	30	62	5.30	6	45	11	8	5	3	7	10	6	11	1	10	2
November.....	30.11	30.84	28.99	1.85	46.3	53.6	39.0	14.6	79	15	64	2.85	6	48	8	5	4	2	6	14	7	14	0	10	2
December.....	30.13	30.92	28.74	2.18	37.2	43.7	30.6	13.1	73	-3	76	3.08	6	54	8	7	3	3	5	13	9	13	1	10	3
Mean.....	30.05				55.4	63.3	47.5	15.8					6		109	84	57	51	110	126	63	124	6	1	16
Total.....												43.18	128												

1 Less than 1.

Meteorological tables compiled by the United States Weather Bureau—Continued.

RICHMOND, VA.

Month.	Barometer at 32° F. and mean sea level.			Air temperature, in °F.						Precipitation (inches).				Wind.										Number of days dense fog.		
	Mean.	Extremes.		Mean.			Extremes.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	Statute miles.	Average number of times (observations at 8 a. m. and 8 p. m.) from—									Number of days with winds of 40 miles or over.	
		Highest.	Lowest.	Range.	Highest.	Lowest.	Range.	N.	NE.							E.	SE.	S.	SW.	W.	NW.	Calm.				
January.....	30.13	31.00	28.92	2.08	37.9	48.3	28.4	16.9	78	—1	79	73	2.66	9	61	9	9	8	6	16	10	4	7	0	1	2
February.....	30.11	30.89	28.00	1.89	38.6	48.4	30.8	17.6	76	—3	79	72	3.30	9	61	9	9	9	5	9	8	5	8	0	1	1
March.....	30.04	30.90	29.04	1.86	47.2	57.1	37.3	19.8	94	14	80	69	3.59	10	54	8	10	5	7	13	8	3	8	0	1	1
April.....	30.02	30.70	29.23	1.47	56.6	67.0	46.2	20.8	96	19	77	66	5.33	9	52	8	7	4	8	15	8	4	6	0	1	10
May.....	30.99	30.56	29.39	1.17	66.5	76.9	56.2	20.7	95	38	57	70	3.85	12	7	7	9	4	11	13	9	3	6	0	1	10
June.....	30.01	30.47	29.44	1.03	74.1	83.8	64.4	19.4	100	46	54	76	3.52	12	60	6	10	5	10	13	8	2	6	0	1	10
July.....	30.01	30.39	29.62	0.77	78.5	88.1	68.8	19.3	100	54	46	76	4.42	11	45	7	8	4	10	17	10	2	4	0	1	10
August.....	30.01	30.42	29.56	.86	76.5	85.6	67.4	18.2	107	52	55	78	3.59	6	45	7	10	5	11	16	6	2	4	1	1	1
September.....	30.07	30.58	29.44	1.14	70.5	80.1	60.9	19.2	100	41	59	77	3.21	6	45	10	14	4	8	10	6	2	5	1	1	1
October.....	30.08	30.59	29.33	1.26	59.5	69.7	49.6	20.1	94	28	66	76	2.95	7	52	12	11	4	6	10	8	3	7	1	3	3
November.....	30.12	30.73	29.12	1.61	48.3	57.9	38.6	19.3	82	19	63	71	2.77	7	46	8	6	2	5	14	11	4	9	1	2	2
December.....	30.14	30.86	29.31	1.55	39.8	48.2	31.3	16.9	74	—2	76	74	2.52	11	53	7	9	2	8	11	9	5	1	1	1	1
Mean.....	30.06				57.9	67.4	48.4	19.0																		
Total.....																										

¹ Less than 1.

Meteorological tables compiled by the United States Weather Bureau—Continued.

NORFOLK, VA.

Month.	Barometer at 32° F. and mean sea level.			Air temperature, in °F.						Precipitation (inches).		Wind.										Number of days dense fog.								
	Mean.	Extremes.		For month.	Mean.			Range.	Average relative humidity.	Average amount of clouds 0-10.	Average fall.	Maximum fall in 24 hours.	Number of days 0.01 inch or more.	Average hourly velocity.	Statute miles.	Average number of times (observations at 8 a. m. and 8 p. m.) from—										Number of days with winds of 40 miles or over.				
		Highest.	Lowest.		Range.	For month.	Mean maximum.									Mean minimum.	Range.	N.	N.E.	E.	S.E.		S.	S.W.	W.		N.W.	Calm.		
January.....	30.13	30.94	28.98	1.96	40.6	48.7	32.6	16.1	80	5	75	76	9	3.37	11	2.22	10	67	10	10	4	5	11	10	6	6	0	0	2	1
February.....	30.11	30.83	29.04	1.79	42.7	50.7	34.7	16.0	81	2	79	74	5	3.75	11	3.45	11	62	10	11	3	5	9	6	6	6	0	0	2	2
March.....	30.03	30.91	29.03	1.88	48.2	56.5	39.9	16.6	92	14	78	74	5	4.28	12	2.78	11	60	7	12	4	8	13	8	5	5	4	0	1	1
April.....	30.01	30.59	29.27	1.32	56.8	65.9	47.7	18.2	95	24	71	72	5	3.79	10	3.15	11	64	8	7	3	8	16	9	4	4	0	1	1	1
May.....	30.00	30.55	29.46	1.09	66.2	75.3	57.2	18.1	98	38	60	75	5	4.07	11	3.78	9	62	7	8	5	9	17	10	4	4	0	1	1	1
June.....	30.00	30.44	29.46	0.98	74.4	82.6	66.2	16.4	102	49	53	77	5	4.33	11	5.97	9	75	4	10	4	11	14	11	3	3	0	1	1	1
July.....	30.00	30.38	29.61	0.77	78.7	86.5	71.0	15.5	102	57	45	79	5	5.80	13	3.60	8	66	4	6	5	8	17	15	4	3	0	1	1	1
August.....	30.00	30.39	29.68	0.71	77.4	84.8	70.0	14.8	105	56	49	81	5	5.97	12	6.03	8	62	5	9	6	11	9	3	2	0	1	1	1	1
September.....	30.06	30.44	29.35	1.09	71.6	78.8	64.4	14.4	100	40	60	79	4	4.06	8	4.23	9	55	8	16	5	8	10	8	3	3	0	1	1	1
October.....	30.07	30.57	29.37	1.20	62.5	69.8	55.2	14.6	91	31	60	78	4	3.91	8	6.29	9	60	11	15	5	5	12	6	4	5	0	1	1	1
November.....	30.11	30.72	29.15	1.57	51.4	58.9	44.0	14.9	81	17	64	75	4	2.72	8	5.48	10	50	11	7	3	4	12	8	8	7	0	1	1	1
December.....	30.13	30.81	29.32	1.49	43.1	50.8	35.4	15.4	75	5	70	75	5	3.49	10	2.52	10	74	12	8	3	6	9	9	7	8	0	1	1	2
Mean.....	30.05				59.5	67.4	51.5	15.9	76	5	76	76	5	49.54	125		10	97	119	50	85	137	109	58	55	0	13	10		
Total.....																														

¹ Less than 1.

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